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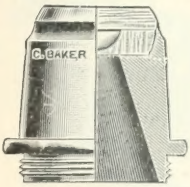

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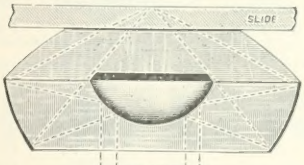

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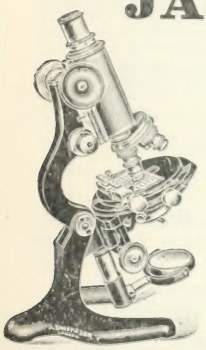

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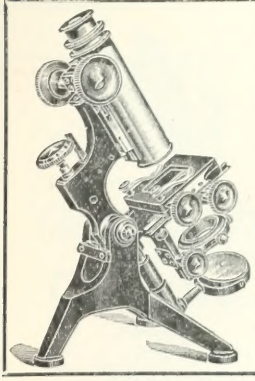

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RECENT WORK ON THE TREATMENT OF SLEEPING SICKNESS: A CRITICAL REVIEW.

By WARRINGTON YORKE, M.D.,
Sectional Editor, Tropical Diseases Bureau.

In recent papers MARSHALL and VASSALLO (1920–1921)* of the Uganda Protectorate describe a method of treatment of human trypanosomiasis which, it is claimed, gives results "better than any hitherto obtained by repeated intravenous or subcutaneous injections of salvarsan, atoxyl, antimony or other preparations." The importance of the subject and the extent of the claims which are made naturally attracted general attention to these papers, and according to an Annotation in the *Lancet*, 10th September 1921, the Colonial Office has already approved of the proposals made by a recently formed body—The Tropical Disease Prevention Association—to send a special mission under the direction of MARSHALL and VASSALLO, at an outlay of £50,000, to investigate the serum treatment of trypanosomiasis in man and animals.

It seems, therefore, that one might with advantage consider the papers in some detail and at the same time discuss, in the light of information which has been acquired during the past few years, a number of important questions which must occur to anyone who studies MARSHALL and VASSALLO's papers in a critical manner.

The work of MARSHALL and VASSALLO is based on two fundamental assumptions :—

1. Although the administration of one dose of salvarsan, neosalvarsan or atoxyl is sufficient to sterilize the blood-stream,

* MARSHALL (1920), *British Med. Jl.*, May 22, p. 702; MARSHALL (1921), *Trans. Roy. Soc. Trop. Med.*, May 20, p. 10; MARSHALL & VASSALLO (1921), *British Med. Jl.*, May 28, p. 773; MARSHALL (1921), *British Med. Jl.*, Aug. 20, p. 84.

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symptoms reappear within a variable period, averaging about four months, and the disease progresses to a fatal termination.

2. This is because quite early in the disease the trypanosomes appear to gain an impregnable position in the central nervous system; in this position they are protected from the action of drugs and from it they are later able to infect the blood-stream again.

Acting on these hypotheses, MARSHALL and VASSALLO devised a mode of treatment which is essentially as follows:—

An intravenous injection of neo-kharsivan 0·6 gm. is given and three hours later 2 oz. of blood are withdrawn and allowed to clot for 20 hours: a volume, varying from 20 mm. to 20 cc. or more, of the serum separated from this blood is then injected intrathecally, after the withdrawal of a corresponding volume of cerebro-spinal fluid.

In subjecting this work to critical examination, we must naturally enquire first, whether the fundamental assumptions on which it is based are correct, and second, whether the results obtained by MARSHALL and VASSALLO justify the claims they make.

It has long been recognized that the results of treatment in advanced cases of sleeping sickness, showing pronounced nervous symptoms, are most unsatisfactory, and it has been generally assumed that the reason is that arsenic and antimony compounds, given by the ordinary channels, fail to reach the parasites in their sheltered position in the central nervous system.

It is doubtful, however, if MARSHALL and VASSALLO are correct when they state that the fact that the metallic medicaments do not reach the cerebro-spinal fluid is due to a pathological change in the meninges brought about by the trypanosomes in the central nervous system.* HALLIBURTON (1921) pointed out at a meeting of the Royal Society of Tropical Medicine and Hygiene, in the discussion which followed MARSHALL's paper, that the cerebro-spinal fluid is a secretion, and that both in health and disease the choroidal cells maintain their rôle of a stalwart barrier, keeping back foreign materials circulating in the blood: only one or two very volatile materials, *e.g.*, alcohol, get through, and there is no passage of poisonous materials like arsenic or antimony from the blood to the cerebro-spinal fluid. Professor Carl VOEGTLIN, on the contrary, informed the reviewer (3rd September 1921) that he had frequently found traces of arsenic in the cerebro-spinal fluid of normal rabbits and syphilitic patients after intravenous injection of large doses of salvarsan and neosalvarsan; and, further, that he had observed that intravenous injection of large doses of these drugs and of atoxyl caused within 24 hours a great diminution in the number of parasites in the cerebro-spinal fluid of rabbits which he had

* Some idea of the conflicting nature of the statements which have been made on this question can be gathered from a perusal of the following papers:—(1) CAMP, C. D. (1912), *Jl. Amer. Med. Assoc.*, Vol. 60, p. 241; (2) DANIEL, G. (1919), *Scalpel*, Aug. 24, No. 15; (3) HALL, G. W. (1915), *Jl. Amer. Med. Assoc.*, Vol. 64, p. 1384; (4) MEHRTENS & MACARTHUR (1919), *Arch. Neurol. & Psychiatry*, Chicago, October, Vol. 2; (5) NIERENSTEIN, M. (1908), *Annals Trop. Med. & Parasit*, Vol. 2, p. 327. (1921), *British Med. Jl.*, June 5, p. 785; (6) SICARD & BLOCH (1912), *Münch. Med. Woch.*, July 23; (7) STILLMAN & SWIFT (1915), *Jl. Exper. Med.*, Vol. 22, p. 286.

inoculated subdurally with a heavy suspension of *T. equiperdum.* An account of this work is to be published shortly.

Possibly the explanation of the discrepancy may be found to lie in the dose of arsenic or antimony administered, small quantities of the drugs appearing in the cerebro-spinal fluid only after the administration of very large, or even toxic doses.

Regarding the question of re-infection of the blood-stream from the cerebro-spinal fluid, MARSHALL quoted KEITH as stating that "while the exact anatomy of the route is unknown, there is no doubt that infections in the basal cisterns do reach the cervical glands, and that very probably this occurs through the nerve-sheaths, where there is some connection between the cerebro-spinal fluid and the lymphatic systems." HALLIBURTON, however, points out that recent experiments by DIXON and himself (1916) showed that this does not take place, but that the cerebro-spinal fluid, which is constantly being secreted by the choroidal cells, does not find an exit by the nerves or lymphatics, but reaches the blood-stream direct *via* the microscopic arachnoid villi which project into the venous sinuses mainly at the base of the brain; this applied also to substances, *e.g.*, methylene blue, which were injected into the spinal fluid.

Leaving MARSHALL and VASSALLO's first assumption for the time being, we will now proceed to enquire what evidence there is to warrant their second assumption, viz., that post-treatment relapses are due to re-infection of the blood by parasites which have been protected from the action of the drug administered, owing to their secluded position in the cerebro-spinal fluid. So far as knowledge goes, there is no reason to doubt that this hypothesis may afford at least a partial explanation of the post-treatment re-invasion of the blood in cases in which the cerebro-spinal fluid itself is infected at the time of treatment; and evidence that trypanosomes can actually pass from the cerebro-spinal fluid to the blood has been obtained by REICHENOW (1914) who injected human blood into the spinal canal of a monkey and found trypanosomes in its blood 21 days later. That it is an adequate explanation why, to quote MARSHALL's words, "attempts to cure patients infected with the trypanosome have, in the vast majority of cases, proved unsuccessful" cannot, however, be accepted without very careful and searching enquiry.

Although well-marked nervous symptoms suggest very strongly that the parasites have invaded the cerebro-spinal system, we can only be absolutely certain by performing a lumbar puncture and demonstrating their presence in the spinal fluid. If there are no nervous symptoms and lumbar puncture is negative, then there is no evidence that the nervous system is involved, and consequently there is no justification for explaining post-treatment relapses in such cases on the assumption that the blood was re-infected from the cerebro-spinal fluid. How early in the disease trypanosomes appear in the cerebro-spinal fluid is still unknown, but REICHENOW (1914) states that, as a rule, the parasites cannot be found in this fluid before the lapse of several months.

GRAY and TULLOCH (1907), who made repeated examinations of the cerebro-spinal fluid of a long series of sleeping sickness patients in

Uganda, give details of two cases in which the cerebro-spinal fluid remained apparently free from trypanosomes for prolonged periods after the disease had been diagnosed by discovery of trypanosomes in the blood or gland juice: in the first case the disease was diagnosed on 15th April 1903, and seven examinations of the cerebro-spinal fluid made during 1903 and 1904 were all negative, trypanosomes being found in this fluid for the first time on 14th February 1905; in the second case the disease was diagnosed on 28th March 1903, and nine examinations of the cerebro-spinal fluid made during 1903 and 1904 were all negative. After 12th December 1904 the patient refused to allow further lumbar punctures, but he was still alive and in fair condition on 1st March 1906.

There are many records of treatment of cases of human trypanosomiasis in quite early stages of the disease—sometimes very shortly after infection—when there was nothing to suggest invasion of the nervous system, and yet it is common knowledge that post-treatment relapses are by no means infrequent in such cases. Lurz (1919) gives an account of the effect of treatment, with salvarsan and atoxyl, of seventeen early cases of human trypanosomiasis who exhibited no signs of disease of the nervous system, and whose cerebro-spinal fluid was normal and did not contain trypanosomes: in nine of the eleven cases treated with salvarsan trypanosomes reappeared in the blood within 1½ months, and in four of the six treated with atoxyl within a month.

The treatment immediately after experimental infection of small laboratory animals, *e.g.*, rats and mice, in which there is no reason whatever for believing that the nervous system is involved, illustrates this point very clearly. The ease with which parasites are caused by medication to disappear from the blood of rats and mice is common knowledge, yet it is equally clearly recognized that the administration of many drugs (even the most efficacious, if administered in inadequate doses) is followed, after a more or less prolonged interval by a relapse, and the parasites reappear in the blood.

In such cases as the above there is, then, no evidence that the reappearance of parasites in the blood is the result of re-invasion from the cerebro-spinal fluid, and we are forced to conclude that the relapse is due either:—(1) to the fact that although the medication resulted in the destruction of the majority of the parasites in the blood, a few escaped—so few that their presence could no longer be recognized by the ordinary tests—and that these gradually multiplied when circumstances were favourable, with the result that they could once more be discovered by blood examination; or (2) that the parasites have hiding places other than the cerebro-spinal fluid, in which they can be protected from the action of drugs, or blood immune-bodies, and from which, when circumstances are favourable, they can again invade the blood. Which of these two alternatives is the true explanation of the occurrence of relapses, we cannot at present decide. It is, of course, obvious that the mere failure to discover trypanosomes in the blood does not mean that they are not present. Macfie and Gallagher (1914) record that in none of 222 cases of trypanosomiasis in the Eket district of Nigeria were trypanosomes found in a drop of peripheral blood; the diagnosis in these cases was made by gland puncture, and it was often necessary to puncture a number of glands before trypanosomes were discovered.

BRODEN (1920) in an interesting paper records the result of examining 336 cases of sleeping sickness in the Belgian Congo: he found that the blood centrifugation method (using 10 cc. of blood) gave a positive result in 80·7 per cent. of cases, and gland puncture in 87·7 per cent.; the ordinary method of direct examination of blood he regards as much less effective. SERGENT, DONATIEN and L'HÉRITIER (1920) state that microscopic examination of the blood of dourine horses in Algeria never revealed the presence of trypanosomes; they add that the best method of making a diagnosis was by massive injections (200 cc.) of the blood of suspected animals into dogs. Instances innumerable might be cited to establish the fact that a mere negative microscopical examination of the blood simply implies that the parasites are not very numerous, and by no means that the blood is really sterile.

As regards the second alternative, the reviewer showed years ago (1911) that in goats infected with *T. rhodesiense* the parasites could multiply readily in the tissue spaces (cornea, subcutaneous tissue, etc.) and, at the same time, be either entirely absent from the blood or present in very small numbers only; he suggested that in these situations the parasites might to some extent escape the action of the blood immune-bodies. A similar demonstration of parasites in the tissues was made later by WOLBACH and BINGER (1912) and by STEVENSON (1917). It is, therefore, quite probable that there may be in the body back-washes of the circulation, or tissue spaces, where the trypanosomes can lie more or less protected from the action of drugs circulating in the blood.

Summarizing the situation, there appears no reason to doubt that the blood stream may be re-infected from the cerebro-spinal fluid, if the latter is already invaded, and that this may, in part at least, explain the relapses which occur after treatment in advanced cases; such a mechanism cannot, however, explain the post-treatment reappearance of trypanosomes in the blood of earlier cases where there is no reason for believing that the nervous system is involved: in these cases the blood stream, provided it is really sterilized by the drug administered, must be re-infected from circulation backwashes, or from tissue spaces, where the parasites have been able to exist protected from the medicant circulating in the blood. Before leaving this question, one cannot but refer to the fact that trypanosomiasis is not the only protozoal infection which it is difficult to sterilize by the administration of drugs: it is a comparatively easy matter to cause the apparent disappearance of the malarial parasites from the blood by the administration of a few doses of quinine, or the apparent disappearance of *Entamoeba histolytica* from the faeces by a few doses of emetine, but although nobody has yet suggested—so far as the reviewer is aware—that these parasites take refuge in the cerebro-spinal fluid, relapses occur with commendable frequency.

Now, unfortunately, notwithstanding the fact that in each instance cerebro-spinal fluid was withdrawn immediately before the serum was injected, we are left in some doubt regarding the state of the cerebro-spinal fluid in MARSHALL and VASSALLO's cases at the time of treatment. It is true that in his first paper (1920) MARSHALL groups his earliest cases (13) into various clinical categories (A, AB, B, BB & C) and then adds "it is suggested that the central nervous system has been invaded in the AB class, though it is possible that this may occur even earlier."

Again, in a more recent paper (1921), it is recorded that the cerebro-spinal fluid was positive in eight of the cases, but the reviewer can find no record that the cerebro-spinal fluid in the other 48 cases was examined at the time of treatment; if this were done however, the inference is obviously that the examinations were negative. That the condition of the cerebro-spinal fluid before treatment in each of the 56 cases is not plainly recorded is a remarkable omission, in view of the fact that the whole object of the intrathecal injection of salvarsanized serum was to sterilize "the second focus of infection in the cerebro-spinal fluid." If the cerebro-spinal fluid were not infected, it is difficult to see what useful purpose an intrathecal injection of salvarsanized serum could be supposed to serve; presumably, it would simply be carried with the cerebro-spinal fluid, which is constantly being formed, back to the blood stream *via* the arachnoid villi.

We have now to consider what evidence there is to suggest that the procedure advocated by MARSHALL and VASSALLO will result in sterilization of cerebro-spinal fluid which is infected with trypanosomes. The evidence on the point adduced by these authors is not very convincing. As mentioned above, the cerebro-spinal fluid was definitely observed to be infected before intrathecal injection of salvarsanized serum in only eight cases (Nos. 7, 10, 30, 33, 39, 42, 44 and 45) and of these three died after treatment, three have not been re-examined since treatment (the time which has yet elapsed being only three or four months) and two are alive and well—with negative gland juice, blood and cerebro-spinal fluid—18 and 6 months respectively afterwards. These last two cases (Nos. 7 and 30) appear to be the sole definite evidence which MARSHALL and VASSALLO produce to substantiate their theory that intrathecal injections of salvarsanized serum result in sterilization of the cerebro-spinal fluid.

Before considering these cases in further detail, reference might well be made to REICHENOW's observations on intrathecal therapy of sleeping sickness recorded as long ago as 1914, and which, although they are very similar to those of MARSHALL and VASSALLO, have apparently escaped the notice of these workers. REICHENOW subjected a number of cases in the second stage of the disease to the following procedure:—

> Two or three hours after an intravenous injection of neosalvarsan, an amount of blood sufficient to produce about 10 cc. of serum was withdrawn; after coagulation, the serum was removed from the clot, mixed with a little water containing ·04 gm. of neosalvarsan and injected into the spinal canal, at least 10 cc. of cerebro-spinal fluid having been previously withdrawn.

It will be seen that this procedure is substantially the same as that recommended by MARSHALL and VASSALLO, the only difference being that REICHENOW adds ·04 gm. of neosalvarsan to the serum before injection. In a later paper REICHENOW gives the results of these experiments: he states that after the intrathecal injections a decrease, or even total disappearance, of the trypanosomes in the cerebro-spinal fluid was observed, *but that the parasites always returned*—a fact which the author explains by the assumption that the medicant had not diffused all through the liquor cerebralis, and more especially had not penetrated into the ventricles of the brain. Whatever the reason, it is

clear that in REICHENOW's hands intrathecal injection of salvarsanized serum appeared to be a failure.

Let us now return to consideration of MARSHALL and VASSALLO's two cases (Nos. 7 and 30): in these the evidence is quite definite, trypanosomes were found in the cerebro-spinal fluid before treatment, but subsequent examinations were negative. As regards Case 7, treatment was administered on June 1st 1919, and the patient was re-examined on five occasions, the last of which was October 26th 1920; the dates of the earlier re-examinations are not given, nor is it stated whether the cerebro-spinal fluid was re-examined on each occasion. The information regarding Case 30 is more precise: treatment was administered on June 15th 1920, and the patient re-examined on November 3rd 1920. Apparently then, the immediate effect of the injection on the cerebro-spinal infection was not ascertained, but we are given the very important information that sixteen and five months respectively after treatment, examination of the cerebro-spinal fluid was negative in the two cases, as was likewise that of the blood and gland juice.

This record is obviously one of such importance that we are compelled to enquire closely into the nature of the observations on which it is based. Unfortunately, however, we can get no further than the somewhat laconic statement that trypanosomes were found in the cerebro-spinal fluid before treatment and were not found after treatment. In the absence of information regarding the method adopted for examining the cerebro-spinal fluid and the intensity of its infection before treatment, it is impossible to assess the value of the record. It is, however, easy to imagine that if the spinal infection is found to be very scanty at the first examination, a subsequent examination may be negative, and indeed in one of REICHENOW's cases (No. 24) this was actually the case. Four examinations of the cerebro-spinal fluid were made in this case—on the first occasion, September 20th 1913, two trypanosomes were found in 10 cc. of fluid, on the second, made January 10th 1914, the examination was negative, and on the other two made, March 16th 1914, and August 5th 1914, a single trypanosome was found in 10 cc. on each occasion.

REICHENOW (1921), as the result of careful examination of numerous cases of sleeping sickness in the Cameroons, has obtained important information regarding the conditions of their cerebro-spinal fluid. His observations can be briefly summarized as follows:—

1. The number of trypanosomes in spinal fluid varied in different cases from one or two to over a thousand in 12 cc. of fluid.

2. The number in any case remained almost constant for long periods.

3. The most striking feature of the parasites in the cerebro-spinal fluid was the large percentage which were in a state of division.

4. The absence of periodic variation in the number of trypanosomes in the cerebro-spinal fluid was due to the lack of trypanocidal antibodies which occur in the blood.

5. Notwithstanding their intense reproduction, the number of parasites in the spinal fluid is kept down by the action of the lymphocytes, which in the cerebro-spinal fluid of sleeping sickness cases are increased in number. The parasites become attached to the lymphocytes and are killed by them; a definite phagocytosis does not occur, the bodies of the trypanosomes undergoing lysis.

6. Lumbar puncture in patients in a state of coma, or exhibiting well-marked somnolence, always reveals very numerous trypanosomes in the

spinal fluid. On the other hand, when only one or two parasites are found in 10 cc. of spinal fluid, there is no indication of somnolence : such persons are indeed, as a rule, symptomless and consider themselves healthy, so that for these cases one can use the term latent sleeping sickness. This condition, in which the parasites in the spinal fluid were so few as to cause no damage to the central nervous system, was observed by Reichenow to persist unaltered for about a year in several cases, and, he adds, it can evidently last a good deal longer.

This last observation has an important bearing on MARSHALL and VASSALLO's Cases Nos. 7 and 30, and leads naturally to the enquiry whether in the absence of intrathecal treatment an infected cerebro-spinal fluid ever becomes sterile. The defensive mechanism described by REICHENOW suggests that this may actually occur, especially if reinfection from outside is cut off as the result of treatment or immune-body formation. Unfortunately, precise information on the point is exceedingly scanty, as few observers appear to have controlled their treatments by lumbar puncture. REICHENOW (1914) in an earlier paper makes the statement that although the administration of atoxyl or salvarsan clears the blood of trypanosomes, it does not cause any reduction in the number of parasites in the spinal fluid ; he does not give any details regarding his observation. However, on searching through the literature, a few records have been discovered of patients whose spinal fluid has been examined before and after treatment, and amongst these there are a number of instances in which an infected spinal fluid has become negative : details of these cases are collected in Table I.

The conclusions to be drawn from Table I appear to be that in the absence of intrathecal treatment (1) an infected cerebro-spinal fluid may actually become negative and (2) patients may live for prolonged periods, and possibly even recover, after the cerebro-spinal fluid has been invaded.

Considerations of this nature force one to the conclusion that MARSHALL and VASSALLO have brought forward no evidence to indicate that an intrathecal injection of neo-kharsivanized serum produces sterilization of the cerebro-spinal fluid.

Turning now to the main issue, let us consider whether the evidence recorded by MARSHALL and VASSALLO warrants the claim that their results " are better than any hitherto obtained by repeated intravenous or subcutaneous injection of salvarsan, atoxyl, antimony or other preparations." A glance at the report of the meeting of the Royal Society of Tropical Medicine at which MARSHALL read his paper shows that, with one or two exceptions, those who took part in the discussion were inclined to accept this claim at its face value. In subjecting it to critical examination, we must do so in association with what I have already referred to as the first of MARSHALL and VASSALLO's fundamental hypotheses, as it is undoubtedly from the standpoint of this hypothesis that the claim is made. Possibly, as MARSHALL writes, " Most authorities are agreed that the administration of one dose of salvarsan, neo-salvarsan or atoxyl is sufficient to sterilize the blood stream, *but within a variable period, averaging about four months, the symptoms reappear, and the disease progresses to a fatal termination.*" It is indeed certain that great numbers of natives died of sleeping sickness during the vast epidemics which ravaged the littoral of Victoria Nyanza during the early years of this century and which are still raging in certain portions of the Congo ; and furthermore, we have abundant evidence that many

persons have died of the disease in regions where sleeping sickness is merely endemic. This, however, does not permit one to lay it down as a generalization, which may serve as a basis for studying problems of epidemiology, treatment and prophylaxis, that in the absence of any treatment, or after one or several doses of salvarsan, neo salvarsan or atoxyl, *a relapse occurs within about four months, the symptoms reappear, and the disease progresses to a fatal termination.*

In order to obtain the evidence which will permit one to speak authoritatively on this subject, it is obvious that we must have information regarding the fate of definite groups of cases which have been under observation for long periods; it is remarkable that precise information on this vital matter is not only very scanty, but is so scattered throughout the enormous literature dealing with sleeping sickness that it hardly can be unearthed by the ordinary worker in the field. The main reason for this appears to be the difficulty experienced, for one reason or another, in following up the cases of the disease for a sufficient length of time. The great majority of papers dealing with treatment simply tell us what happened within a comparatively short space of time, *e.g.*, that so many relapsed within a few weeks or months; they do not tell us the ultimate fate of the individual cases comprising the group treated.

The reviewer has asked himself three questions :—

(1) What proportion of trypanosomiasis cases, which are untreated, die of the disease, or, conversely, are alive after more or less prolonged periods?

(2) What proportion of cases, which are treated with one or several doses of arsenic or antimony compounds, die of the disease, or, conversely, are alive after more or less prolonged periods?

(3) What proportion of cases, which are subjected to prolonged treatment, die of the disease, or, conversely, are alive after more or less prolonged periods?

Doubtless these appear to be simple questions, but to obtain any information which might enable us to answer them has been a surprisingly difficult task. As the result of laborious search, in which the reviewer has been greatly assisted by Miss D. Allmand, the librarian of the Liverpool School of Tropical Medicine, a certain amount of information has been collected from the literature, and this is summarized in Tables II–IV.

It will be seen from Table II that a proportion of cases of trypanosomiasis had survived in their natural surroundings, where they were presumably subject to re-infection, for very considerable periods without any treatment at all; some of the cases were in good health and, as far as could be ascertained, free from infection three to eight years after the disease had been diagnosed. The observations suggest that a certain percentage of cases may recover spontaneously.

Table III shows that a considerable percentage of cases had survived either in their natural surroundings, or in isolation camps, for periods varying from one to two years up to eight or nine years after they had received only one to several injections of some arsenical compound. Many of the cases were well and apparently free from infection at the end of the observation period. It will be observed that to some extent different results were obtained by different observers; probably these differences are to be explained, in part at

least, by the condition of the patients when treated, *e.g.*, compare the results obtained with arsenophenylglycin by AUBERT and HECKENROTH in their first series of observations (1911) with those obtained by them in 1913, and with those of V. d. HELLEN (1913). The figures published by CLAPIER in 1921 are most illuminating in so far as they give the fate of a large group of unselected cases, left in their natural surroundings, 6½ years after treatment with only one to three injections of atoxyl. The general conclusion to be drawn from the observations presented in Table III appears to be that the great majority of early cases (and even of unselected cases) are alive and well, and many of them apparently free from infection, one to two years after treatment with a few doses of an arsenical compound; and the fact that many have survived for such long periods as 6½ to 9 years and are apparently well and free from infection suggests that not a few had actually recovered.

Table IV shows that the majority of the early cases subjected to prolonged arsenic or antimony treatment were alive and well 1½ to 7, or more, years after the condition was diagnosed. It is not easy to explain the extraordinarily high mortality among the Uganda cases; it will be seen, however, that practically all the cases were well advanced and many of them very ill before treatment was commenced. Furthermore, the observations were made during a terrible epidemic and the natives were collected into isolation camps. Possibly during the epidemic the trypanosome developed an exalted virulence, and possibly the resistance of the native was lowered by removing him from his natural surroundings and providing him with food which was in some respects inadequate; these are questions, however, which are beyond the scope of the present review. In considering the comparatively heavy mortality among the 50 Europeans cited by BAGSHAWE (1910), it must be remembered that many of the cases occurred in early years before the discovery of the value of atoxyl (1905); and this also applies to three of the four fatal cases cited by DANIELS (1915).

It is clear from the information presented in Tables II to IV that MARSHALL's first fundamental hypothesis cannot be accepted without very considerable qualification, as apparently a large proportion of trypanosomiasis cases have survived, either in their natural surroundings, or in isolation camps, for prolonged periods, after receiving only a single, or at most several, injections of some arsenic or antimony compound.

In the absence of controls it is almost impossible to appraise the value of treatment. For example, are we to infer that the fact that at least 34·6 per cent. of OUZILLEAU's 1,078 cases were alive, and most of them well and apparently free from infection, 6½ years after diagnosis, is due to the one to three injections of atoxyl which they had received at the time diagnosis was made? It is impossible to answer this, unless we know how many would have been alive after a similar period if no treatment had been given. Doubtless there are serious objections to the use of controls in therapeutic experiments in a disease like sleeping sickness, but one cannot help feeling that if such work were properly controlled by observations of an adequate series of untreated cases, it would be an inestimable advantage in determining the value of treatment.

Returning now to MARSHALL and VASSALLO's contention that their intrathecal treatment has given results better than any hitherto obtained by repeated injection of salvarsan, atoxyl and antimony or

other preparations, let us examine the figures upon which this claim is based. Of the 52 (presumably unselected) cases treated by intrathecal injection, 22 have so far not been re-examined, as they were treated within 1 to 3½ months of writing the report, and we know nothing about them, except that one is dead; of the remaining 30 cases, 6 (20 per cent.) are dead, 2 have not been re-examined, and the others (22) are alive and well after observation periods which in 2 cases were 24 to 27 months, in 7 cases 12 to 19 months, and in 13 cases 6½ to 8 months.

Now it is remarkable that amongst MARSHALL's cases are two controls (Nos. 14 and 28) who received only a single intravenous injection of neokharsivan: both were alive and well, with negative blood, gland juice and cerebro-spinal fluid, 13 and 7½ months respectively after treatment. One would imagine that this alone might well have given MARSHALL and VASSALLO pause, and have prevented them from making a claim which, on the data which they have so far accumulated, is absolutely unjustifiable. If further evidence on this point is required, we have only to compare MARSHALL and VASSALLO's figures with those summarized in Tables III and IV and particularly with those of AUBERT and HECKENROTH (1913) and ZUPITZA (1920) in Table III, and of CLAPIER (1921) in Table IV, the observation period for which is at least equal to that of MARSHALL and VASSALLO, to realize how utterly unwarrantable is the statement that the intrathecal treatment has given better results than any hitherto obtained by repeated injection of salvarsan, atoxyl, antimony or other preparation.

Having regard to economy of space, the reviewer has purposely refrained from discussing the case of the European (Mr. X) to which MARSHALL appears to attach so much importance. That there is no justification for asserting that the apparent cure had anything to do with the intrathecal injection of salvarsanized serum must be obvious to anyone who reads the records of the case, for the following reasons:—(1) The case was an early one; (2) there is no evidence that the cerebro-spinal fluid was ever invaded; (3) trypanosomes were found in the blood 39 and 88 days respectively after the intrathecal injection; and (4) many cases are on record which have lived in perfect health for as long as, or indeed much longer than, Mr. X, and have been apparently cured by a single injection of neosalvarsan, or some other arsenical preparation (*vide* Table III, especially ZUPITZA, 1920, and CLAPIER, 1921).

Conclusions.

The main criticisms which can be levelled at MARSHALL and VASSALLO's papers can be summarized as follows:—

(1) The work is based on two fundamental assumptions, both of which are incorrect, or at least can only be accepted with very considerable qualification.

(2) The treatment is not new, even for trypanosomiasis, but is substantially the same as that tried by REICHENOW in 1914, and abandoned by him as useless in that it failed to sterilize the cerebro-spinal fluid.

(3) MARSHALL and VASSALLO produce no satisfactory evidence that intrathecal injections of salvarsanized serum sterilize infected cerebro-spinal fluids.

(4) The results, so far published, fail to substantiate the claim that the treatment gives better results than any hitherto obtained by other methods.

TABLE I.—Giving records of cases in which trypanosomes disappeared lived for prolonged periods after their

Author.	Number of cases showing trypanosomes in the cerebro-spinal fluid before treatment.	Treatment.	Case.
Gray & Tulloch, Uganda, 1907 ..	3	No treatment	A
		,, ,, ...	B
		,, ,, ...	C
Broden & Rodhain, Leopoldville, Belgian Congo, 1908.	3	Atoxyl: 8 injections of 0·5 gm., followed by orpiment orally till the 31st day.	A B C
Martin & Leboeuf, Brazzaville, French Congo, 1909.	1	Atoxyl and afridol violet, repeated injections.	
Broden & Rodhain, Leopoldville, Belgian Congo, 1909.	1	Atoxyl: 31 injections 0·5 gm. ..	
	4	Atoxyl: 0·4 to 0·5 gms. and emetic, 0·1 gm., repeated injections. ,, ,, ,, ,, ,, ,,	A B C D
Martin, Leboeuf & Ringenbach, French Congo, 1909.	31 10 died. 11 disappeared. 10 re-examined, of which3 were found to be negative.	Atoxyl and emetic: several injections	A B C
Martin & Darré, 1910	1 European with marked somnolence	Atoxyl: repeated injections during 8 months.	
Todd, Congo, 1911	1	Liquor arsenicalis, at intervals ..	
Martin & Darré, 1914	1 With marked nervous symptoms.	Irregular treatment	

TABLE II. follows TABLE IV.

from the cerebro-spinal fluid after treatment; and also of cases who cerebro-spinal fluid was found to be infected.

Condition of the cerebro-spinal fluid.					Remarks.
1st exam. before treatment.		Later observations after treatment.			
Trypanosomes per 10 c.c.	Cells per c.mm.	Time after 1st exam.	Trypanosomes per 10 c.c.	Cells per c.mm.	
+	Very few	61st and 79th days	0	Very few	Further examinations between the 321st day and death on the 705th day all positive.
		157th day	+	,, ,,	
		194th and 243rd days	0	,, ,,	
+	,, ,,	61st day	0	,, ,,	Alive.
		100th and 136th days	+	,, ,,	
		161st and 200th days	0	,, ,,	
		230th day	+	,, ,,	
+	,, ,,	99th, 124th and 164th days	0	,, ,,	
		195th day	+	,, ,,	Alive.
+	750	53 days	0	196	
+	193	53 ,,	0	32	
+	625	53 ,,	0	30	
+	Abundant	41 days	0		
+	640	7 months	0	38	Considerably improved.
		9 ,,	0	65	
+	226	3½ months	0	38	Condition stationary.
		6½ ,,	0	125	
+	187	3½ ,,	0	28	In good health.
		6½ ,,	0	9	
+	500	3½ ,,	0	30	Considerably improved.
+	245	3½ ,,	0	53	Considerably improved.
+ very rare		10 months	0		In good health.
		12 ,,	0		
+		7 ,,	0		In good health.
		9 ,,	0		
+		6 ,,	0		In good health.
		7½ ,,	0		
+					Alive and well 4 years later.
+					Alive and well 5 years later.
+	Numerous				Still alive after 4 years; condition unchanged.

on page 172.

TABLE III.—Showing the fate, after more or less prolonged had received only one or several injections

Author.	Number of cases and by whom treated.	Condition of cases at time of treatment.	Treatment.	Length of observation period of survivors.
Aubert & Heckenroth, French Congo, 1911.	33, Martin & Ringenbach, 1909	All in 2nd or 3rd stage of disease	Arsenophenylglycin : a series of injections at irregular intervals ; 0·5–4 gm.	2 years
Montfort, French Congo, 1912	253, Aubert, 1911	Unselected cases during an epidemic	Atoxyl : 1 injection; ? dose	5–6 months
Aubert & Heckenroth, French Congo, 1913.	29	15 : good condition 14 : bad ,,	Arsenophenylglycin : 2 injections at 4 or 5 days' interval ; 0·45 gm. per kilo.	11 : 6–11 months 9 : 12–15 ,, 5 : 18–25 ,,
	11	9 : in 2nd stage 2 : in 3rd stage	Atoxyl : 7–14 injections	3 : 8–12 months 8 : 14–20 ,,
v. d. Hellen, Togoland Camp, 1913.	233, v. Raven, 1911	Almost all in an early stage	Arsenophenylglycin : 2 injections on successive days ; 0·04–0·06 gm. per kilo.	6 : 3–6 months 34 : 7–8 ,, 33 : 9–11 ,, 111 : 12–23 ,, 10 : 24–35 ,,
Lafont & Dupont, Senegambia, 1914.	34	5 : very advanced 15 : advanced 2 : moderate 12 : early cases	Ludyl or galyl: 4 injections ; various doses	12–19 months
Zupitza, Togoland Camp, 1920.	19	In 1st stage of disease, but with definitely enlarged glands	Neosalvarsan : 2 intramuscular injections ; 8–9 mgm. and 12–13 mgm. per kilo.	11–12 months
	25	,, ,,	Neosalvarsan : 1 or 2 intramuscular injections ; about 15 mgm. per kilo.	15–16 months
	20	,, ,,	Salvarsan : 2–5 intravenous injections ; 8·0–8·3 mgm. per kilo	18–19 months
Simson, Yei Camp, Sudan, 1920.	17, Yei Camp, 1911		Salvarsan : 3 intramuscular injections suspended in olive oil ; 0·5–0·6 gm.	8 years
	4, Yei Camp, 1911		Arsenophenylglycin : 2 injections, 1 gm and tryparosan, orally on 3 successive days, 8–9 gm.	9 years
Clapier, French Congo, 1921	1,078, Ouzilleau, 1913–14	Unselected cases during an epidemic	Atoxyl : 1–3 injections ; 1 gm. for an adult, 1·5 to 2 cgm. per kilo. for a child	6½ years

* This figure is calculated on the assumption that those which had disappeared,

periods, of various Groups of Sleeping Sickness Cases which
of some Arsenic or Antimony Compound.

Number. disappeared.	Number dead.	Number alive.	Percentage of original total alive assuming that all who had disappeared had died.	Percentage of original total alive assuming that all who had disappeared were alive.	Remarks.
2	25	6	18·2	24·2	Of [illegible] alive, 3 in bad con[illegible], 1 moderate, 1 well.
81	24	148	58·5	90·5	Of the 148 alive, only 25% were found to be still infected.
0	4	25	86·2		The 4 dead were all bad cases when treatment began. Of the 25 alive, 22 were in good condition.
0	0	11	100·0		Of the 11 alive, 6 were in good condition with negative blood.
2	8 of other diseases. 29 relapsed and were put on other treatment	194	83·2	95·6*	None of the 194 had relapsed; all were well and considered cured.
0	15	19	55·9		Of the 15 dead, 9 were advanced cases before treatment. Of the 19 alive, 4 were still infected.
0	0	19	100·0		Of the 19, 16 had not relapsed and were considered to be cured; 3 had relapsed, were re-treated and provisionally cured.
0	0	25	100·0		Of the 25, 21 had not relapsed and were considered to be cured; 4 had relapsed, were re-treated and provisionally cured.
0	0	20	100·0		Of the 20, 19 had not relapsed and were considered to be cured; 1 had relapsed, was re-treated and provisionally cured.
0	9	8	47·0		[illegible]
0	2	2	50·0		[illegible] small-pox.
167	538	373	[illegible]	[illegible]	Of the 373 alive, only 70 were found to be still infected.

and those which had relapsed and were put on other treatment, were all alive.

TABLE IV.—Showing the fate, after more or less prolonged had received more or less

Author.	Number of cases and by whom treated.	Condition of cases at time of treatment.	Treatment.	Length of observation period of survivors.
Hodges, Uganda: all S.S. Camps, 1910.	1,185 admitted Dec. 1906 to Nov. 1907.	140: in apparently good health. 517: with definite signs of disease. 528: advanced cases.	Various prolonged treatments, chiefly arsenical.	(*a*) after 2 years. (*b*) after 4 years.
Hodges, Uganda: Busiro Camp only, 1910.	399 admitted Dec. 1906 to May 1907.	65: with definite signs (*e.g.* fever, enlarged glands) 177: more advanced (drowsiness, impotence, tremor of tongue). 109: advanced cases, very ill, with marked nervous symptoms. 16: semi-comatose. 32: condition not stated.	Various prolonged treatments, chiefly arsenical.	3½–4 years.
Bagshawe, 1910	50 Europeans, treated by various workers.	—	Various prolonged treatments.	3–7 years.
v. d. Hellen, Misahöhe Camp: Togoland, 1913.	57	Almost all early cases.	Atoxyl: 15–20 double injections every 10th and 11th, or 11th and 12th days; 0·5 gm.	7: 37–42 months 22: 43–48 months
Macfie and Gallagher, Ikotobo Camp, Eket, 1914.	167	Unselected cases	Atoxyl: weekly injection; 6 grs.	8–19 months.
Daniels, 1915	13 Europeans, treated at the London School of Tropical Medicine.	—	Prolonged arsenical, mostly atoxyl.	2: 5–6 years 5: 9–10 ,, 2: 12–14 ,,
Greggio, Belgian Congo, 1917	51, Greggio, 1907 36, ,, 1908 29, ,, 1909 39, ,, 1910 90, ,, 1911 51, ,, 1912 79, ,, 1913 50, ,, 1914	Mostly early cases from personnel of Mission. Unselected cases from the surrounding districts.	Repeated doses of arsenic. ,,	8 years. 7 ,, 6 ,, 5 ,, 4 ,, 3 ,, 2 ,, 1 ,,
Simson, Yei Camp: Sudan, 1920.	35, Ranken, 1913	15: early cases with enlarged glands. 20: more advanced with nervous symptoms.	Metallic antimony: 5 injections at intervals of 4 days; an interval of 6 weeks; 3 injections at intervals of 4 days; 1 grn.	7 years.
	29, Ranken, 1913	Selected cases	Metallic antimony: 15 injections at intervals of 3 days, 1 grain; and salvarsan, 2 injections, 0·4 gm.	6 years.
	23, Ranken, 1913	Selected cases	Three courses each consisting of metallic antimony, 5 injections, 1 grain; and atoxyl, 12 injections, 5 grs.	6 years.

periods, of various groups of Sleeping Sickness cases which prolonged courses of treatment.

Number disappeared.	Number dead.	Number alive.	Percentage of original total alive assuming that all who had disappeared had died.	Percentage of original total alive assuming that all who had disappeared were alive.	Remarks.
182 224	734 912	269 49	22·7 4·1	38·2 23·0	Of the 49 alive, 3 were in good health, 19 showed definite signs of disease, and 27 were advanced cases.
65	313	21	5·2	21·5	Of the 21 alive, all showed signs of disease.
7	30	13	26·0	40·0	26 died within 2 years of diagnosis; 4 within 2–6 years. Probably at least a dozen of the deaths occurred before the introduction of atoxyl as a remedy.
7	5 of other diseases 16 relapsed and were put on other treatment.	29	5[illegible]·9	91·2	None of the 29 had relapsed; all were well and considered cured.
0	9	158	94·6		All in fair health.
0	4	9	69·2		3 of the 4 cases died before the introduction of atoxyl in 1905.
0 0 0 0 0 0 0 0	31 20 19 27 52 34 50 34	20 16 10 12 38 17 29 16	39·0 44·4 34·4 30·7 42·2 33·3 36·7 32·0		
27	20	8	22·8	42·8	Of the 8 alive, [illegible] in good condition.
0	11	18	62·0		All in good condition, but 2 died in 6th year of small-pox and cerebro-spinal meningitis.
0	4	19	82·6		17 [illegible]

TABLE IV.—Showing the fate, after more or less prolonged
had received more or less

Author.	Number of cases and by whom treated.	Condition of cases at time of treatment.	Treatment.	Length of observation period of survivors.
Simson, Yei Camp: Sudan, 1920—*cont.*	96, Ranken, 1913	Unselected cases	Metallic antimony and atoxyl: more or less continuous treatment for 2 years.	6–7 years.
	63, Yei Camp, 1912.	35: good condition. 27: fair condition. 1: poor condition.	Atoxyl: subcutaneous injections every 10 days for 3 months, repeated after an interval of 1 month; 1 gm.	7–8 years.
	11, Yei Camp, 1913.	5: good condition. 6: fair condition	,, ,,	7 years.
	7, Yei Camp, 1914.	1: good condition. 6: fair condition	,, ,,	6 years.
	19, Yei Camp, 1915.	—	Atoxyl: subcutaneous injections every 3 days up to 2 years; 5 grs.	5 years.
	5, Yei Camp, 1916.	—	Salvarsan: 2 injections at 10-day intervals; and atoxyl, injections every 3 days for 1 year; 5 grs.	3 years.
Clapier, French Congo, 1921	3147	Unselected cases	Atoxyl: repeated injections averaging 2–6 per case each six months; 1 gm. for adult, 1·5–2 cgm. per kilo. for child.	17–18 months

TABLE II.—Showing the fate, after more or less prolonged periods, of

Author.	Number of cases and by whom observed.	Condition of cases at time of first observation	Treatment.	Length of observation period of survivors.
Nattan-Larrier, French Congo, 1908	3 Europeans ..	—	Nil.	A: 17 months. B: 3 years. C: 2 years.
Todd, 1911	5, Dutton & Todd, Gambia, 1902.	—	Nil.	2–3 years.
	102, Dutton & Todd, Congo, 1903.	—	Nil.	30–40 months.
Heckenroth, Oubangui, French Congo, 1913.	35, Leboeuf, 1907..	—	Nil.	6 years.
Wade, Ashanti, 1913	97, Kinghorn, 1910	—	Nil.	3 years.
	32, Wade, 1911–12..	—	Nil.	1–2 years.
Greggio, Belgian Congo, 1917 ..	33, Greggio, 1911 ..	—	Nil.	4½ years.
Todd, Gambia, 1919	12, Todd & Wollbach, 1911.	—	Nil.	8 years.
Kleine, New Cameroons, 1919 ..	565, Montfort, 1911	—	? Nil.	3 years.

periods, of various groups of Sleeping Sickness cases which prolonged courses of treatment.—*cont.*

Number disappeared.	Number dead.	Number alive.	Percentage of original total alive assuming that all who had disappeared had died.	Percentage of original total alive assuming that all who had disappeared were alive.	Remarks.
2	43	51	53·1	55·2	33 in good, 13 in fair, 5 in poor condition.
0	23	40	63·5		29 in good, 6 in fair, 3 in poor condition; 2 died in 8th year from small-pox and large burn.
0	5	6	54·5		All the 5 in good condition.
0	3	4	57·1		2 in good, 1 in fair, 1 in poor condition.
0	6	13	68·4		[illegible] condition.
0	1	4	80·0		2 in good, 2 in fair condition.
0	509	2,638	83·8		Of [illegible] died during the first 6 months and only 25 per cent. during the next 12 months.

various groups of Sleeping Sickness cases which remained untreated.

Number disappeared.	Number dead.	Number alive.	Percentage of original total alive assuming that all who had disappeared had died.	Percentage of original total alive assuming that all who had disappeared were alive.	Remarks.
0	0	3	100·0		A and B had relapsed with cerebral symptoms; C [illegible]
0	1	4	80·0		Of the 4 alive, all were well, but by the end of 7 years [illegible]
?	?	?	33·0		[illegible]
8	21	6	17·1	40·0	All the 6 in [illegible]
?	?	20 " at least "	20·6 " at least "		
?	?	9 " at least "	28·1 " at least "		
0	24	9	27·2		
0	8	4	33·3		[illegible]
?	50·7 per cent.			49·3	[illegible] Kleine's statement that in [illegible] cases were dead.

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*References are to summaries in the *Tropical Diseases Bulletin* unless otherwise stated.

MEDICAL ZOOLOGY.

JOHNSON (J. Pratt). **The Routine Examination for Blood Parasites of all Troops returned from a Tropical Campaign.**—*Jl. Roy. Army Med. Corps.* 1921. April. Vol. 36. No. 4. pp. 282–290.

The object of this paper is to record a practical experience of routine blood examination on the large scale, where the number of smears to be dealt with approached 250,000.

Special laboratories were established, adjacent to central hospitals: here recruits, mostly ladies, were trained for the work. The thick smear method was adopted, supplemented only in special cases by films. The smears were merely dried thoroughly, but without direct exposure to sun; only if—as in prolonged drying in hot weather—they became discoloured were they haemolysed with acid alcohol. Two watery staining solutions were kept in stock, one of one per cent. eosin, the other of one per cent. Azur II, the latter being made afresh about once a week. For staining, 2 cc. of the former were diluted with 220 cc. of distilled water and 4 cc. of the latter added: the simply dried smears were flooded for 20 to 30 minutes, and were haemolysed as well as stained by the process; finally, the smears were removed to distilled water until they began to show pink. In each case laboratory reports were entered along with treatment-record on a special card.

For smooth working, laboratory reports were generally made within 24 hours; in one instance a batch of 1,000 smears was dealt with and reported on in that time at one laboratory.

The laboratory medical officers were always available for bedside consultation when required.

Good smears could be made by a capable N.C.O. or a sister, and the necessary laboratory forms completed by them or by a convalescent.

A. Alcock.

SCOTT (Henry Harold). **The Incidence of Intestinal Parasites, especially with regard to the Protozoa, amongst Symptomless Carriers in Jamaica.**—*Ann. Trop. Med. & Parasit.* 1921. July 16. Vol. 15. No. 2. pp. 117–132.

This is a minutely particularized account of a very careful investigation of the stools of 102 hospital cases of both sexes, none of which was under suspicion of, or admitted for, any intestinal complaint. In the investigation the concentration method of CROPPER and ROW was followed, and in each and every case nine separate stools were examined at regular intervals during a term of three weeks. Cysts of *Entamoeba coli* were found in 47·00 per cent., *E. histolytica* in 14·7 per cent., *Giardia intestinalis* in 35·29 per cent., *Chilomastix mesnili* in 12·74 per cent., and *Balantidium coli* twice.

A. A.

MORSTATT (H.). **Die Rolle der tierischen Parasiten und Krankheitsüberträger im ostafrikanischen Feldzuge.** [The Rôle of Animal Parasites and Disease Carriers in the East African Campaign.]—*Zeitschr. angew. Ent.* Berlin. 1921. Feb. Vol. 7. No. 2. pp. 287–295. [Summarized in *Rev. Applied Entom.* 1921. June. Vol. 9. Ser. B. Pt. 6. pp. 92–93.]

Malaria was the most important disease; benign tertian appeared to have increased. Blackwater caused many deaths. The commonest

tsetse-fly is *G. morsitans*. *G. brevipalpis* also is widespread. *G. austeni* occurs in the north of Tanganyika Territory and in British East Africa.

Ceratopogon was sometimes very troublesome. Phlebotomus fever occurred at Dar-es-Salaam. *Cordylobia anthropophaga*, *Auchmeromyia luteola*, and *Tunga* (*Dermatophilus*) *penetrans* were pests. Even Europeans were troubled with body-lice. *Ornithodorus moubata* is the only relapsing-fever tick in East Africa, and there were several cases of that disease among Europeans.

A. A.

LAVIER (Georges). **Les parasites des invertébrés hématophages ; parasites qui leur sont propres ; parasites qu'ils transmettent aux vertébrés.**—218 pp. 1921. Paris : Vigot Frerès, Editeurs, 23 rue de l'Ecole-de-Médecine. [Price not stated.]

This is a most useful catalogue of the known species of blood-sucking Annelids and Arthropods, arranged according to zoological system. In the case of each species what is known about it, both as a mere harbourer of specific parasites of its own, and as a transmitter or intermediate host of parasites of vertebrates, is circumstantially stated, all statements being appropriately referred to their original sources in a bibliography that fills 35 pages. Minor items are a brief biological classification of these blood-sucking invertebrates, and an impartial discussion of the ulterior significance of insect flagellates. It is a very valuable compilation.

A. A.

JUNG & SELL. **Zur Kenntnis des Vorkommens von Darmparasiten in Südbayern.** [Study of the Incidence of Intestinal Parasites in Southern Bavaria.]—*Münch. Med. Woch.* 1921. Apr. 29. Vol. 68. No. 17. pp. 511–512.

Examinations made at Munich of the stools of Bavarians and Swabians, which had been sent in for the purpose of diagnosis from cases of typhoid, paratyphoid and dysentery ; a few only were sent for examination for evidence of worms. The stools of 380 cases were examined ; 65 contained eggs of various worms, 66 cysts of protozoa, and 8 contained both. Of worms Ascaris was found in 29 cases, Trichocephalus in 46, and Oxyuris in 4. Of protozoan cysts *Entamoeba coli* was found in 66 cases, and Lamblia in 13.

Two examinations were made of each stool.

A. A.

MESNIL (F.). **Variété des voies d'accès des parasites sanguicoles à leurs hôtes.**—*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14 No. 6. pp. 310–315.

Though there is much that is interesting and suggestive, there is nothing novel in this paper. After a cursory review of the biological methods by which the various kinds of blood-parasites gain access to their proper hosts, the author concentrates on the trypanosomes, and on the question whether, as LEGER conjectured, the primitive hosts of these parasites are invertebrate, or vertebrate, as MINCHIN thought more probable.

Reasoning from four well-established propositions, namely, (1) that the rat is infected with its specific trypanosome by swallowing infected faeces of the rat flea, (2) that intestinal flagellates of certain vertebrates are known to invade the blood of their host, (3) that each class of vertebrates has at least one group of trypanosomes particular to itself, and (4) that in one and the same class of vertebrates the specific trypanosome parasites, notwithstanding their common facies are severally communicated by specific arthropods of very different orders, the author supports the view of MINCHIN.

A. A.

NÖLLER (W.). **Neuere Forschungen auf dem Gebiete der Blutparasiten unter den Sporozoen.** [Recent Investigations on the Position of the Haemoparasites in the Sporozoa.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1920. Vol. 24. No. 11. pp. 353–355. With 1 text fig.

Another illustrated argument for the derivation of haemoparasitic Sporozoa from enteroparasitic Sporozoa.

A. A.

i. KRAUS (R.), DIOS (R.) & OYARZABAL (J.). **Ueber ein unsichtbares Stadium bei pathogenen Protozoen (Piroplasma, Anaplasma und Trypanosomen).** [On the Ultramicroscopical Stages of Pathogenic Protozoa (Piroplasma, Anaplasma, and Trypanosomes).]—*Muench. Med. Woch.* 1921. July 15. Vol. 68. No. 28. pp. 867–868.

ii. KLEINE (F. K.). **Bemerkungen zu dem Aufsatz von Professor R. Kraus, Dr. R. Dios und J. Oyarzabal.** —*Ibid.* 1921. Aug 26. Vol. 68. No. 34. p. 1085.

i. After a brief historical review of the hypothesis of ultra-microscopic stages of protozoon infections, the following experiments are recorded:—

1. A sheep after receiving a subcutaneous injection of blood from an ox infected with many "pirosomata" subsequently exhibited no positive result to continuous examination. But an ox receiving a subcutaneous injection of blood from this sheep exhibited anaplasma 38 days afterwards, which remained demonstrable for a month; and a calf injected from the same sheep also showed anaplasma (28 days afterwards) which remained visible for 20 days.

2. Again, another sheep inoculated from an ox which had been infected with piroplasma, but at the time showed only anaplasma in the blood, gave negative results; yet the blood of this sheep infected a calf with anaplasma, and this anaplasma infection was passed on from the first calf through two other calves.

3. A sheep was injected subcutaneously with blood of a horse infected with *Trypanosoma equinum*; the result was negative. Yet guinea-pigs inoculated a month afterwards with the blood of this sheep showed trypanosomes in their blood in the course of 18 days. Of three more guinea-pigs, however, inoculated from this same sheep 48 days later on, only one showed trypanosomes subsequently.

4. Details are given of three series of experiments where sheep inoculated with blood of guinea-pigs infected with *Trypanosoma gambiense* gave uniformly negative results; yet guinea-pigs inoculated with the blood of these sheep developed trypanosomes in their blood.

5. A sheep injected with blood of a guinea-pig infected with "Trypanosoma surrae"; result negative. A guinea-pig injected 18 days afterwards with the blood of this sheep showed trypanosomes 13 days subsequently.

ii. Kleine has some trenchant criticism of these experiments. He himself has failed to discover evidence of any invisible phase of piroplasma, anaplasma, and trypanosome.

A. A.

ESCOMEL (E.). **Les hémoparasitismes et les hémoporteurs de germes. Procédé rapide et sûr pour l'examen des leucocytes et des parasites dans le sang.**—*Bull. Soc. Path. Exot.* 1921. May 11. Vol. 14. No. 5. pp. 291–299.

For the study of leucocytes and of blood parasites the author recommends dissolving away the red cells by means of a solution of acetic acid (1 per cent.), and centrifugation of the residue.

A. A.

SÜTTERLIN (Theobald). **Ueber die Einwirkung chemischer Stoffe auf freilebende Protozoen.** [On the Action of Chemical Substances on Free-living Protozoa.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1921. Vol. 25. No. 4. pp. 99–114.

This paper gives at considerable length the results of a comparative study of the action of certain chemical substances upon free Protozoa. The substances used were tetrahydrooxymethoxydichinolinchlorohydrat (in dilutions of 1–1,000 to 1–10,000), optochin (1–5,000 to 1–100,000), vuzin (1–5,000 to 1–100,000), and eucupin (1–5,000 to 1–100,000), and the Protozoa used were Amoeba, a Chlamydomonad flagellate near Polytomella, and two ciliate Infusoria, namely Colpoda and Paramoecium. The interesting point of the experiments made was that in solutions strong enough to have an appreciable effect within a limited time (24 hours), the flagellate was distinctly more sensitive and the two Ciliates were vastly more sensitive than the amoeba, which last, having no protective pellicle, might have been assumed to be the least sensitive. The remarkable sensitiveness of the Ciliates is attributed by the author to their possession of a mouth through which the hurtful chemicals would reach the innermost protoplasm more rapidly.

A. A.

BARRET (Harvey P.). **A Method for the Cultivation of Blastocystis.** —*Ann. Trop. Med. & Parasit.* 1921. July 16. Vol. 15. No. 2. pp. 113–116.

The culture medium here approved is 10 per cent. of human blood serum in a solution of 0·5 per cent. of common salt. The salt solution is sterilized in the autoclave and the serum added after inactivation for half an hour at 55° C. The medium is served in narrow test-tubes so as to give a column 100 mm. high, and for the initial operation a small portion of stools or of an emulsion of faeces in salt solution is placed in the bottom of the test-tube. The best growth occurs at the bottom of the medium; none occurs at the surface. If good growth has taken place in 24 hours a transplant can be made; cultures 72 hours' old are hardly ever good for this purpose.

In cultures, budding, as described by ALEXIEFF, and binary fission are the methods of multiplication observed. In hundreds of preparations the multiple division form of ALEXIEFF, pictured by WENYON and O'CONNOR has been seen on only two occasions. A great variation in size is exhibited. Since large vacuolate forms are commonly found in old cultures from which successful transfers cannot be made, these forms are inferred to be degenerate. No flagellate and no amoeboid forms were seen. The author concludes that Blastocystis is a definite zoological genus.

A. A.

NÖLLER (W.), KROSZ (K.) & ARNDT (A.). **Die Rhizopodenfauna des Pferdekotes und des Strassenstaubes in ihren Beziehungen zu Darmpassanten des Menschen.** [The Rhizopod Fauna of Horse Dung and Road Sweepings in its relation to Intestinal Parasites of Man.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1921. Vol. 25. No. 4. pp. 114–120.

The comparative study of the fauna of the faeces of animals is here vindicated, and the following forms observed by the authors are mentioned: several species of *Chlamydophrys* found respectively in faeces of horse and pig, and also in road scrapings and manure; other testaceous amoebae—perhaps of the genus *Plagiophrys*—from horse dung; *Trinema enchelys* from horse and pig; *Gromia oviformis*, from horse and manure; a fifth kind of testacean—Cochliopodium—from horse, pig, mouse, and also from manure and road sweepings; *Sappinia diploidea* bred freely from road sweepings, also from pig, horse and mouse; *Dactylosphaerium* (?) *hartmannelia* from road sweepings and straw refuse, and also from pig and pigeon; Limax amoebae of the Vahlkampfia type, from horse and from road sweepings.

A. A.

LAVERAN (A.) & FRANCHINI (G.). **Des hématozoaires du gecko et spécialement de *Herpetomonas tarentolae*. Procédé simple de culture des *Herpetomonas*.**—*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14. No. 6. pp. 323–326. With 1 text fig.

The gecko species *Tarentola mauritanica* in Algeria and Tunis is often infected with haematozoa: *Haemogregarina platydactyli* Billet, *Trypanosoma platydactyli* Catouillard, *Herpetomonas* sp. E. & E. Sergent and others, *Pirhemocyton tarentolae* Chatton and Blanc (endoglobular), *Trichomastix* sp. Chatton.

The authors examining 17 geckos of this species from Italy found trypanosomes in six and Herpetomonas in eight (in four individuals both species together), but did not find any of the other Protozoa above mentioned. Herpetomonas, as is known, grows well on simplified Novy medium; the authors find that it also thrives on peptonized broth with a few drops of rabbit-blood added.

A. A.

ZOTTA (G.). **Sur la culture en milieu N.N.N. du *Leptomonas pyrrhocoris*.**—*C. R. Soc. Biol.* 1921. May 7. Vol. 84. No. 16. pp. 822–824.

Leptomonas pyrrhocoris is an intestinal parasite of *Pyrrhocoris apterus* which passes through the walls of the intestine into the body

cavity and ultimately the salivary glands. It is easily cultivated in N.N.N. medium. In culture the flagellates sink to the bottom of the liquid of condensation, where they undergo modifications leading to a "barley-corn" stage. They then agglomerate in masses quite unlike rosettes and multiply actively. The young forms grow directly into acicular forms identical with those found in the blood of the bug.

A. A.

LAVERAN (A.) & FRANCHINI (G.). **Sur un** *Herpetomonas* **du loir.**—*Bull. Soc. Path. Exot.* 1921. May 11. Vol. 14. No. 5. pp. 278–280. With 1 text fig.

Description and figures of a Herpetomonas from a dormouse (*Myoxus glis*). The principal forms in blood, liver and spleen are leishmanias; in the blood and liver were also seen larger elongate non-flagellar forms, and a few typical flagellar Herpetomonads. Fleas were searched for in vain.

A. A.

REULING (Fritz). **Zur Morphologie von** *Trichomonas vaginalis* **Donné.**—*Arch. f. Protistenk.* 1921. Vol. 42. No. 3. pp. 347–363. With 1 plate and 4 text figs.

Trichomonas vaginalis is described at a length of 15 pages. The material was obtained from the Heidelberg female clinic, the flagellate being found in 46 out of 250 cases complaining of abnormal discharges. The author notes that although it has long been accepted that *T. vaginalis* lives only in acid secretions, a frothy alkaline secretion containing *Micrococcus alcalescens gazogenes* is also particularly good soil, as was discovered by SCHRÖDER and LÖSER.

The author states with emphasis that the axostyle of *T. vaginalis* consists of four distinct fibrillae.

A. A.

PRINGAULT (E.). **Étude biologique de** *Trichomonas intestinalis.*—*Bull. Soc. Path. Exot.* 1920. Dec. 8. Vol. 13. No. 10. pp. 800–803.

The author describes the appearance and behaviour of this well-known flagellate, its susceptibility to antiseptics, etc., the method of laboratory culture, and the unsuccessful results of attempts at experimental infection of laboratory animals.

A. A.

CLAPIER (P.). **Note sur un flagellé de la famille des Tetramitidae, parasite fréquent des plaies à caractère phagédénique.**—*Bull. Soc. Path. Exot.* 1921. Apr. 13. Vol. 14. No. 4. pp. 208–211.

Description of a flagellate very closely related to Tetramitus and Trichomonas, found in phagaedenic sores and ulcers of various kinds and usually in association with spirochaetes and fusiform bacilli. Mention is also made of another flagellate having only two anterior flagella and devoid of an undulating membrane, found in suppurations of another kind.

These parasites are not accidental, but it is not necessary to attribute any pathogenic significance to them, is the author's conclusion.

A. A.

BOECK (William C.). *Chilomastix mesnili* **and a Method for its Culture.** —*Jl. Experim. Med.* 1921. Feb. 1. Vol. 33. No. 2. pp. 147–175. With 5 text figs.

A description full of detail, with excellent figures of free and encysted forms. The culture medium recommended is composed of one part of human serum and four parts of Locke's solution, with the addition of a small amount of dextrose. Locke's solution is made up as follows :— Sodium chloride 0·9 gm., calcium chloride 0·024 gm., potassium chloride 0·042 gm., sodium bicarbonate 0·02 gm., distilled water 100 cc. Add 0·25 gm. of dextrose ; sterilize ; add serum. A loop of faeces rich in flagellates is washed by stirring it in 2 cc. of warm sterile normal saline. Two drops of the wash are mixed with another lot of normal saline ; and two drops of this, again, are mixed with a third lot of saline. This is to get rid of excess of bacteria and faecal detritus. One or two drops of the washings are inoculated into a culture tube and incubated at 37° C. If the culture is successful flagellates are found in increasing numbers up to the fourth day afterwards, when they decrease and gradually disappear on the eighth or tenth day. In the author's cultures longitudinal binary fission was often observed ; multiple (quadripartite) fission also occurred ; paired flagellates were often seen during the first three days, but no exchange of nuclear substance was observed.

A. A.

REULING (F.) & RODENWALDT (E.). *Giardia–Lamblia?*—*Arch. f. Protistenk.* 1921. Vol. 42. No. 3. pp. 337–346. With 2 text figs.

While agreeing that *Lamblia intestinalis* and *Giardia agilis* are rightly included in one and the same genus, the authors think that *Lamblia* might be distinguished as a subgenus.

In this case the subgenus *Lamblia* would be defined as squat pear-shaped flagellates having the front part of the body cupped and the peristome kidney-shaped, the parabasal apparatus obliquely transverse and buckle-shaped, and moving with much action but little progress, like a rocking-horse [a rajah's horse would be a better description].

The cognate subgenus *Giardia* would be defined as slender flagellates with a head-like front and a deep transverse muzzle-like peristome, a longitudinally disposed club-like parabasal apparatus, and a serpentine mode of progression.

A. A.

BOECK (William C.). **Studies on** *Giardia microti.* —*Univ. California Public. Zool.* 1919. April 7. Vol. 19. No. 3. pp. 85–134. With 19 text figs. and 1 plate.

The following are the main conclusions of this sedulous study. *Giardia microti* has a cycle of encystment, with a maximal period of about seven days. Both in the free and in the encysted stages it multiplies both by binary and by octuple fission. Its parabasal bodies are acidophil, are of cytoplasmic origin, and are a reserve of glycogen for reproduction and for encystment. Its tenure is not affected by bismuth subnitrate and salicylate.

A. A.

RIBEIRO DA FONSECA (Olympio Oliveira). **Estudos sobre os Flagellados Parasitos. On Some Parasitic Flagellata.**—*Mem. Inst. Oswaldo Cruz.* 1920. Vol. 12. No. 1. [Portuguese version.] pp. 51–65. With 2 plates. [English translation.] pp. 48–59.

A well-illustrated paper in which the generic status of *Tetrachilomastix, Chilomitus* and *Waskia* are upheld and several of the author's species of parasitic flagellates are redescribed.

A. A.

KOFOID (Charles Atwood). **A Critical Review of the Nomenclature of Human Intestinal Flagellates, Cercomonas, Chilomastix, Trichomonas, Tetratrichomonas, and Giardia.**—Reprinted from *Univ. California Public. Zool.* 1920. June 28. Vol. 20. No. 6. pp. 145–168. With 9 text figs.

" 1. *Cercomonas* is not as yet proved to be a human intestinal parasite, but coprophilic species of this genus occur in stale stools or in stool cultures. *Cercomonas* of clinical literature is probably *Chilomastix.* Flagellate stages of *Craigia* may have been reported as *Cercomonas.*

" 2. *Cercomonas hominis,* Davaine (1860), was a complex of two species. His var. *A.*, named *Cercomonas davainei* by Moquin-Tandon (1860), is *Chilomastix.* The correct name for *Chilomastix* is not *C. mesnili* (Wenyon) but *C. davainei* (Moquin-Tandon).

" 3. Davaine's *Cercomonas hominis* var. *B* is the human intestinal *Trichomonas,* the correct name of which is *T. hominis* (Davaine). *Cercomonas obliqua* Moquin-Tandon (1860), *Trichomonas intestinalis* Leuchart (1879), and *T. confusa* Stiles (1902) are synonyms of *T. hominis.*

" 4. The type species of *Trichomonas* Donné (1837) has four free anterior flagella, hence *Tetratrichomonas* Parisi 1910 is a synonym of *Trichomonas. Trichomonas hominis* from the intestine and *T. buccalis* from the mouth also have four flagella.

" 5. A flagellate of the mouth was first described by O. F. Müller (1773) as *Cercaria tenax,* but the description and figure are too meagre to permit re-identification. *Tetratrichomonas buccalis,* Goodey and Wellings (1917), should be transferred to *Trichomonas.*

" 6. A new genus *Tritrichomonas* is established for trichomonad flagellates with three anterior free flagella with *T. augusta* Alexeieff, as type species.

" 7. *Giardia enterica* (Grassi) 1881 has priority over *Lamblia intestinalis* (Lambl), Blanchard 1888, and over *Giardia lamblia* Stiles 1915."

A. A.

WENYON (C. M.). **Observations on the Intestinal Protozoa of Three Egyptian Lizards, with a Note on a Cell-Invading Fungus.**—*Parasitology.* 1920. Dec. Vol. 12. No. 4. pp. 350–365. With 2 plates and 2 text figs.

The precise and finely illustrated descriptions in this paper include a leptomonad flagellate found in packs in the cloaca and adjoining part of rectum—but not in any of the tissues, or even invading the cells of the local mucosa—of a *Chameleon vulgaris* ; and a Bodo, a Trichomonas, a Trichomastix, as well as a large Entamoeba resembling *E. coli* and forming eight-nucleate cysts indistinguishable from those of *E. coli,* all from lizards.

In discussing the particular leptomonad the author recapitulates his views on the difficult subject of classification and nomenclature of the flagellates of this series, and he rehearses a system of grouping them which, though not professing much merit as a classification,

is undoubtedly a good enough provisional focalization. In this system the terms leptomonas, leishmania, crithidia, herpetomonas, and trypanosoma have, severally, an adjectival usage in reference to type of form, and a generic meaning in respect of type of life-history. Thus (1) leptomonads living exclusively in invertebrates, and producing leishmania forms that escape and are distributed in faeces, constitute the genus Leptomonas ; (2) leptomonads existing in one phase as such (or occasionally as leishmania forms) in an invertebrate, and in another phase as leishmaniae in a vertebrate, form the genus *Leishmania* ; (3) crithidians living exclusively in an invertebrate, and producing leishmania forms in the posterior part of the invertebrate's gut, form the genus *Crithidia* ; (4) trypanosome forms (with concurrent intermediate forms of the lower types) living exclusively in invertebrates, constitute the genus *Herpetomonas* ; and (5) trypanosomes (with concurrent intermediate forms of lower types) living both in invertebrates and vertebrates, constitute the genus *Trypanosoma*. The leptomonad of Euphorbias stands apart as *Phytomonas* Donovan.

In dealing with the Bodo the author describes its proliferation in the encysted stage very fully, and has occasion to discuss the significance of the term Blastocystis, giving a qualified adhesion to the view that under this name three distinct entities may have been confused, namely, true protozoon cysts, low vegetable organisms, and degenerate protozoa or even degenerated tissue-cells.

A. A.

PATTON (W. S.), LA FRENAIS (H. M.) & SUNDARA RAO. **Studies on the Flagellates of the Genera** *Herpetomonas, Crithidia* **and** *Rhynchoidomonas.*

No. 2. The Morphology and Life History of *Crithidia ctenocephali*, **sp. nov., Parasitic in the Alimentary Tract of** *Ctenocephalus canis*, **Curtice** [by Patton & Sundara Rao].

No. 3. The Morphology and Life History of *Rhynchoidomonas siphunculinae*, **sp. nov., Parasitic in the Malpighian Tubes of** *Siphunculina funicola*, **de Meijere** [by Patton].

No. 4. The Morphology and Life History of *Herpetomonas siphunculinae*, **sp. nov., Parasitic in the Alimentary Tract of** *Siphunculina funicola*, **de Meijere** [by Patton].

No. 5. The Morphology and Life History of *Herpetomonas pulicis*, **sp. nov., Parasitic in the Alimentary Tract and Malpighian Tubes of** *Pulex irritans*, **L.** [by Patton & Sundara Rao].

No. 6. Note on the Behaviour of *Herpetomonas pulicis*, **Patton and Sundara Rao,** *Crithidia ctenocephali*, **Patton and Sundara Rao, and** *Herpetomonas muscae domesticae*, **Burnett, in the Bed Bug,** *Cimex hemiptera*, **Fabr.** [by Patton, La Frenais & Sundara Rao].—*Indian Jl. Med. Res.* 1921. Apr. Vol. 8. No. 4. pp. 593–602. With 1 plate: 603–612. With 2 plates: 613–620. With 1 plate: 621–628. With 1 plate: 629–632.

No. 2.* *Crithidia ctenocephali* [a rather unfortunately chosen specific name] is parasitic in the alimentary tract of larva, pupa, and adult of *Ctenocephalus canis*. The larva is infected from the excreta

* No. 1 of this series was published in 1912 [see this *Bulletin* Vol. 1, p 1].

of the adult—its chosen food. The small round preflagellar stage, which simulates the round stage of the kala azar parasite, is found only in the larva. The flagellar stage is best seen in the stomach of the larva, the typical mature flagellate being elongate, and having the flagellum attached for a short distance to the anterior end. The end of the flagellar stage, which occurs in the larva, but also in the nymph and adult, is characterized by the formation of small spindle or oval flagellates. The post-flagellate stage—small round forms, sometimes with a tag of a flagellum—may be found in the hind-gut, though never in the rectum of the larva, but more usually occurs attached to the wall of the rectum of the adult.

The parasite has no connection with any trypanosome of the dog; nor can the dog be infected experimentally either by feeding or inoculation.

No. 3. *Rhynchoidomonas siphunculinae* is a natural parasite in the Malpighian tubules of the eye-fly (*Siphunculina funicola*); it has no connection with the Herpetomonas found in the gut of that insect. It is a typical flagellate, but distinct from either Herpetomonas or Crithidia; the adult is fusiform and has a short flagellum stretching from the vicinity of the blepharoplast (which is always behind the nucleus) to the anterior end but with no free continuation; in its life-history it exhibits the same phases as other insectan Herpetomonas and Crithidia; the fly is infected by ingesting the post-flagellate forms passed in the faeces of other individuals.

No. 4. *Herpetomonas siphunculinae* is a natural parasite in the alimentary canal of the eye-fly; it has not been seen in the Malpighian tubules. It develops normally in the alimentary tract of the larva; at a late stage of life it exhibits a characteristic trypanosome appearance, and might be mistaken for a trypanosome, and this stage was observed in flies nurtured in a test-tube and never fed on vertebrate blood. Owing to the habit of the eye-fly of feeding on sores, cuts, conjunctival secretion, etc., the author thinks that this its parasite may become pathogenic to man.

No. 5. *Herpetomonas pulicis* is a natural parasite of *Pulex irritans* and has been recorded in Europe, though according to the authors it has never been described. The larval flea becomes infected probably from the faeces of the adult; in the larva and pupa the parasite lives in the stomach, but in the adult flea it inhabits the Malpighian tubules in the flagellar stage and the hind gut and rectum in the post-flagellar stage. The authors, who accept the view that human leishmaniasis has its antecedents in insect herpetomoniasis, regard this flagellate of the human flea with misgiving.

In all the foregoing papers the respective flagellates are copiously figured in all their stages.

No. 6. In a batch of bugs (*Cimex hemiptera=rotundatus*) fed on culture of *Herpetomonas pulicis* individuals examined up to 48 hours afterwards had plenty of flagellates in the mid and hind gut, and a few were found in the hind gut and rectum of an individual examined on the seventh day; but after that none could be detected in any part of the gut of any individuals examined; by culturing the gut, however, on successive days after the feed, the existence of flagellates could be demonstrated even on the 37th day after the original infective feed. The significance of these observations for experimental work is obvious.

A. A.

HOARE (Cecil A.). **Some Observations and Experiments on Insect Flagellates, with Special Reference to Artificial Infection of Vertebrates. (A Report to the Department of Scientific and Industrial Research.)**—*Parasitology.* 1921. Mar. Vol. 13. No. 1. pp. 67–85.

The paper starts with a review of the history of the crithidia (*C. melophagia*) of the Ked (*Melophagus ovinus*), rightly conjectured by WOODCOCK to be the praeter-vertebrate form of the trypanosome (*T. melophagium*) of the sheep upon which the Ked is parasitic, but afterwards declared by several authors to be a specific parasite of the Ked itself and transmitted from one generation of Keds to another as a heritage. The author was engaged in experiments which did not tend to confirm those authors' statements when he became acquainted with papers by NÖLLER (*Arch. f. Schiffs- u. Trop.-Hyg.* 1917 and 1919; and *Deut. Tierärztl. Woch.* 1920) containing the experimental proof that WOODCOCK's conjecture was right. This led him on to investigate the work of certain authors, notably LAVERAN and FRANCHINI, and FANTHAM and PORTER, who, from experiments with various species of flagellates parasitic in the gut of insects, have come to the conclusion that those flagellates—particularly those of insects associated with vertebrates—are definitely pathogenic to vertebrates, FANTHAM, as is well known, having embodied his conclusions in the formula that Leishmaniases of vertebrates are arthropod-derived herpetomoniases.

The author has repeated some of these experiments. He has inoculated mice—a total of 15 experiments—with the crithidia of the Ked, with the herpetomonas of the blowfly, and with the herpetomonas of the water-scorpion; he has fed and inoculated sticklebacks and newts, and has inoculated frogs, with the herpetomonas of the water-scorpion—a total of 35 experiments: and he presents here the records and results of his experiments, each and all. In no case, whether he proceeded by microscopical investigation or by cultural methods, did he find any trace of infection in the animals fed or inoculated.

The author does not state that his experiments disprove the conclusions of the other observers, but only that the results of his experiments are contrary to theirs, and therefore show that the subject requires further study.

He does, however, make some damaging criticisms of some of the incongruous experiments. For instance, FRANCHINI and MANTOVANI stated that blood cultures from a rat inoculated with *Herpetomonas muscaedomesticae* produced only "anaplasma" bodies, and that these when re-inoculated into a mouse gave rise to Leishmania forms; now whatever these questionable anaplasma forms may be, there are no grounds for connecting them with flagellates. Again, in the experiments of LAVERAN and his collaborators references to Leishmania forms with a single nucleus are frequent. Furthermore, in these observers' experiments the inoculation of mice with *Crithidia melophagia*—proved by NÖLLER to be the antecedent form of the trypanosome of the sheep—produced Leishmanias and not trypanosomes in the mice.

The author has some significant observations on the vitality of some of the insect flagellates. Flagellates can remain alive in the intestine of fish for 5 hours, or even for 18 hours, and when injected into the

peritoneal cavity, for 4 days. Crithidia in the contents of the Ked's gut diluted with saline, lived for a day at a temperature of 30° C., and for 7 days at room-temperature. Herpetomonas in the contents of the water-scorpion's gut diluted with saline, or with alkaline nutritive bouillon, lived for 5 days at room-temperature. No multiplication was observed in these cases.

A. A.

McCulloch (Irene). **A Comparison of the Life-Cycle of *Crithidia* with that of *Trypanosoma* in the Invertebrate Host.**—*Univ. California Public. Zool.* 1919. Oct. 4. Vol. 19. No. 4. pp. 135–190. With 3 text figs. and 5 plates.

The purpose of this paper is to compare the structure and life-cycle of the Crithidia of a plant-feeding bug with the crithidia stages of a Trypanosoma in the invertebrate host: *Crithidia euryophthalmi*, parasitic in the gut of the lupin bug, *Euryophthalmus convivus*, is compared with the crithidia phases of *Trypanosoma lewisi* in the rat-flea, as described by Minchin and Thomson, though the comparison is somewhat complicated by the fact that in the bug the stomach portion of the midgut consists of three distinct chambers.

The lupin bug is infected not from the lupin, in the sap of which nothing suggesting any known phase of a flagellate can be detected, but from spores passed in infective bug-faeces. On reaching the anterior chamber or "crop," the spores rapidly develop into crithidias, and the mature crithidias may either (*a*) be carried onwards through the stomach; or (*b*) may undergo multiple endogenous intracellular fission in the "crop"-wall, much as *T. lewisi* does in the epithelial cells of the flea's stomach; or (*c*) may undergo multiple endogenous extracellular fission in the crop, giving rise by degeneration to something which suggests the "latent bodies" described by Moore and Breinl in the life-cycle of *T. gambiense*; or (*d*) may multiply by ordinary binary fission.

Owing to the aforesaid complexity of the bug's stomach, it is not easy to say where exactly the stomach phase ends and the rectal phase begins; but in the third or pyloric chamber, three distinct types of the flagellate are definitely established, namely (*a*) free forms, which may be either slender, elongate crithidias, or small, non-flagellar ovoids, having a superficial resemblance to the initial infective spores, (*b*) attached squat forms, and (*c*) infective spores.

In the rectum only the infective spores are found: they are small, oval, non-flagellar forms with a thick periplast, a nucleus, a parabasal body, and possibly a faint nuclear rhizoplast.

Degenerative forms of all kinds are to be found in the pyloric expansion of the stomach, but they are not seen in the rectum.

The author concludes that there are more parallel stages and phases in the life-cycle of *Crithidia euryophthalmi* and *T. lewisi* than are to be met with in comparing any trypanosome and herpetomonad (or leptomonad) known, and therefore, that the evolution of a trypanosome has probably been from a crithidian rather than from a herpetomonad (or leptomonad)

A. A.

i. LAVERAN (A.) & FRANCHINI (G.). **Contribution à l'étude de la flagellose des euphorbes.**—*Bull. Soc. Path. Exot.* 1920. Dec. 8. Vol. 13. No. 10. pp. 796–800.

ii. SERGENT (Étienne). **Existence de *Leptomonas davidi* dans le latex d'euphorbiacées d'Algérie** (*E. peploides*).—*Arch. Instituts Pasteur de l'Afrique du Nord.* 1921. Mar. Vol. 1. No. 1. p. 58.

iii. ZOTTA (G.). **Un leptomonas du type *L. davidi* Laf. chez des Euphorbes de France.**—*C. R. Soc. Biol.* 1921. July 2. Vol. 85. No. 24. pp. 226–228.

i. At Bologna, in certain species of Euphorbia, the authors have found, besides the typical Flagellate, some non-flagellate spherical and oval forms, both uninucleate and binucleate.

The authors have successfully inoculated healthy Euphorbias of two species with pure cultures of *Herpetomonas ctenocephali* var. *chattoni*.

They have also inoculated white mice, peritoneally, with the latex of naturally infected *Euphorbia nereifolia*, and in two cases where the animal survived the immediate effects, leishmaniform parasites were subsequently found in the blood.

ii. Flagellates have been searched for in several hundred individuals of several species of Euphorbia, in Algeria, during some years and only in one case with success, *Leptomonas davidi* having been found in a *Euphorbia peploides*.

iii. A record of the occurrence of a Leptomonas corresponding "assez exactement" with *L. davidi* in *Euphorbia esula* var. *mosana* and *E. helioscopia* at Ponligné.

A. A

NOC (F.). **Nouveau cas de Coccidiose intestinale humaine à Isospora.**—*Bull. Soc. Path. Exot.* 1920. Dec. 8. Vol. 13. No. 10. pp. 785–789.

Case of a French colonial soldier four years a prisoner under the most insanitary conditions in German camps, where sometimes he had to fight for his food with rats. At times, in common with fellow prisoners, some of whom died thereof, he suffered from diarrhoea. When under treatment, after his release, for recurring attacks of a liquid, blackish, foetid diarrhoea, cysts of Lamblia and oöcysts of a Coccidiid were found in the stools.

The oöysts were 22–23μ in the major, 10–16μ in the minor diameter. Under ordinary laboratory treatment they increased in size and ripened into sporocysts containing two spores each holding 4 sporozoites.

The patient was treated with novarsenobenzol intravenously, and with cachets of thymol, and though the diarrhoea and the oöcysts persisted for some time during treatment they ultimately disappeared. The author is not yet satisfied that the disappearance is final. He compares the oöcysts with others that have been described from human stools.

A. A.

SNIJDERS (E. P.). **On the Cysts of a Hitherto Undescribed Species of *Eimeria* in Human Stools.**—*Parasitology.* 1920. Dec. Vol. 12. No. 4. pp. 427–432. With 1 text fig.

The author describes, figures, and discusses the oöcysts, and their contents, of an undescribed Coccidium found in Sumatra in the stool

of a patient who had been under treatment for chronic amoebic dysentery, and in whose stools the usual forms of *Entamoeba histolytica* had been found proper to the relapses and the dormant intervals respectively.

Comparing the oöcysts with those of *Eimeria oxyspora* and *E. wenyoni*, he remarks, as the most obvious difference from the former, the absence of " crystalline bodies " in the sporozoites ; and, from the latter, the larger size of the oöcyst, and the slenderer and more sharply pointed spores.

A. A.

DOBELL (Clifford). **A Note on the New Species of *Eimeria* found in Man by Dr. E. P. Snijders.**—*Parasitology.* 1920. Dec. Vol. 12. No. 4. pp. 433–436.

After remounting and re-examining some of Dr. SNIJDERS' material this author pronounces it to be a new species which he names *Eimeria snijdersi*, and characterizes as follows ;—

" Oöcyst colourless, spherical, 40–48μ in diameter. Spores fusiform, equally pointed at both ends ; length 20–25μ, width in middle 7–8μ. Oöcystic residue small, granular. Sporocystic residues in the form of one or two small refractile spheres. No ' crystalline bodies '—like those of *E. oxyspora*—visible at the posterior end of the sporozoites."

The author mentions incidentally that of the two coccidia of man reported since the publication of his own " Revision," one, recorded by LOCKHART-MUMMERY and GABRIEL, is not a Coccidium or even a Protozoon at all ; and the other, reported by HUETTER as occurring in a rectal tumour, is probably not a case of coccidiosis.

A. A.

PHISALIX (Marie). **Coccidiose des serpents.**—*Bull. Soc. Path. Exot.* 1921. Feb. 9. Vol. 14. No. 2. pp. 82–84.

Notes of cysts of Coccidia in the bile-ducts and gall-bladder of several species of snakes.

A. A.

SERGENT (Edm.) & ESPÉRANDIEU (G.). **Études sur les piroplasmoses et les jaunisses en Algérie. viii. À propos d'un accès suraigu de piroplasmose bovine à petites formes annulaires extrèmement nombreuses.**—*Bull. Soc. Path. Exot.* 1920. Dec. 8. Vol. 13. No. 10. pp. 779–783. With 2 text figs.

A case of bovine piroplasmosis difficult for specific identification. The great majority of the parasites were small rings ; there were also some rods, both vacuolated and non-vacuolated, and a few anaplasma forms ; but not any pear-forms, or paired forms, or cross-forms.

A. A.

SERGENT (Edm.). **Étude morphologique du *Piroplasma* (*Gonderia*) *mutans* du boeuf.**—*Ann. Inst. Pasteur.* 1921. Mar. Vol. 35. No. 3. pp. 193–203. With 1 coloured plate.

The author has made a detailed study of 1369 piroplasms answering to the characters of *Piroplasma* (*Gonderia*) *mutans* from six Algerian

bovines—three in good health and three differently infected—and the following is the statement of his conclusions :—

In observed cases a slight infection—an average of 5·9 up to a maximum of 20 red corpuscles in 1,000 infected—is consistent with an excellent state of health.

P. mutans exists in two principal forms, namely (1) annular (round or elliptical) with a large vacuole, and (2) bacilliform, both of which exhibit schizogony. These two forms, with all their varieties, were found in all six bovines but in very different proportions : in two animals the rings constituted 80 per cent., in the other four only 25 per cent. In their schizogony the annular forms end in a quaternary (sometimes ternary ?) division : the young bacilliform elements show in 40·8 per cent. of cases a binary division.

Furthermore *P. mutans* exhibits coarse bacilliform elements with round or oval nucleus, having the characters of gametes

Among 229,800 red corpuscles examined in the investigation of the 1,369 piroplasms, 15 forms answering to the definition of Anaplasma or equally to that of Jolly bodies were seen.

A. A.

DU TOIT (P. J.). **Experimentelle Studien ueber die Pferdepiroplasmose** [Experimental Studies on Piroplasmosis of the Horse. — *Arch. f. Schiffs- u. Trop.-Hyg.* 1919. Vol. 23. No. 16. pp. 359–368. With 1 text fig.

The author failed to transmit the infection of *Piroplasma caballi* by means of *Ixodes ricinus*, but succeeded with *Dermatocentor reticulatus*. The latter species can be infected as a larva and becoming infective as a nymph can retain the infection and carry it on to the adult stage.

A. A.

KUDO (R.) **Microsporidia Parasitic in Copepods.**—*Jl. Parasit.* 1921. Mar. Vol. 7. No. 3. pp. 137–143. With 2 text-figs.

Description and figures of *Nosema cyclopis*, parasitic in the fat body and perhaps in the reproductive organs of *Cyclops fuscus* ; and *N. infirmum*, parasitic in the fat body, reproductive organs and muscles of *Cyclops albidus* ; both being new species seemingly fatal to their hosts. Descriptions of six other recorded species of Microsporidia parasitic in Copepods are also included in the paper, and a useful list of references to the subject is appended.

A. A.

FRASER (A. D.). **Notes on Blood-Sucking Flies in North Russia during the Summer of 1919.**—*Bull. Entom. Res.* 1920. Dec. Vol. 11. Pt. 3. pp. 195–198.

The species observed include 4 of Culicoides, 6 of Simulium, 5 of Chrysops, 2 of Haematopota, and 9 of Tabanus, besides *Anopheles maculipennis* and 3 other Culicinae, and *Stomoxys calcitrans*. Though some of them were extremely troublesome they were not proved to have any specific pathogenic importance to men or domestic animals.

A. A.

MacGregor (Malcolm E.). **A New Type of Entomological Killing-Bottle.**—*Bull. Entom. Res.* 1920. Dec. Vol. 11. Pt. 3. pp. 283–285. With 1 text-fig.

The author confirms the many objections to potassium cyanide, and figures and describes in necessary detail an ingenious killing-bottle containing a small reservoir of chloroform.

A. A.

Nigeria. **Annual Medical and Sanitary Report of the Northern Provinces, Nigeria, for the Year ending 31st December, 1918.** [Johnson (W. B.)]. pp. 48–50. With 3 maps.

In 1914 an entomological survey of the Kaduna district of Northern Nigeria, by Dr. J. E. L. Johnston, revealed only one specimen of *Glossina tachinoides* (on the Kaduna R.) and two specimens of *G. palpalis* (on the Tubo R.). The author when shooting in the same district between May 1917 and May 1918 found *G. tachinoides* to be common and widely distributed along the Kaduna during the dry season, and along all its tributaries and also along those of the Tubo during the rains, and he also found *G. palpalis* in many places.

In view of cases of sleeping sickness having occurred at Kaduna capital the author considers this revival and diffusion of Glossina to be a matter of importance.

A. A.

Takatsuki (Akira). **Die echte Wirkungsweise des Petroleums auf die Insekten.** [The Real Action of Petroleum on Mosquito Larvae.]—*Kyoto Igaku Zassi.* 1920. Sept. Vol. 17. No. 9. pp. 1051–1057. (37–43.) [In Japanese. German Autoreferat. pp. 67–70].

The author from his experiments confirms a very widely accepted conclusion that petroleum acts on mosquito larvae not mechanically but as a poison. He, however, goes further, and states that it has a selective effect on the epithelium of the air-tubes.

A. A.

Roubaud (E.). **Les diptères et la pathologie exotique.**—*Bull. Soc. Path. Exot.* 1921. Feb. 9. Vol. 14. No. 2. pp. 58–65.

An interesting lecture on the general aspects of the subject; nothing technical or novel.

A. A.

Chanal (Louis). **Rôle pathogène des moustiques en pathologie humaine et comparée. Répertoire des espèces pathogènes et des parasites qu'elles transmettent.**—91 pp. 1921. Paris: Vigot Frères, Éditeurs, 23, rue de l'École-de-Médecine. [Price not stated.]

This is a valuable and useful compilation, and will undoubtedly be much appreciated, including as it does exact references, systematically arranged and specifically assorted, to what has been recorded from observation and experiment of the pathogenic activities of the Culicidae, together with a comprehensive bibliography. There are also

some judicious remarks on the question as to what constitutes a dangerous species from the malaria standpoint. There may be one or two quite unimportant and innocuous deviations from a rigid taxonomy.

A. A.

MARTINI (E.). **Ueber Stechmücken- und Kriebelmückenzucht.** [The Artificial Breeding of Mosquitoes and Simuliids.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1921. Vol. 25. No. 4. pp. 120–121.

Some difficulties in breeding mosquitos and other midges are here referred to [Everyone who has bred Anopheles from the egg knows how difficult it is to keep the larvae supplied constantly with the right food] and the author here recommends a substance called Piscidin. (Gustav Haberle, Hamburg 23, Börnestrasse 36) as particularly good nutriment. It is rubbed to a powder and sprinkled thinly on the surface of the water, and it does not sink quickly.

A. A.

PURDY (W. C.). **Biological Investigation of California Rice Fields Relative to Mosquito Breeding. Progress Report.**—*Public Health Rep.* 1920. Oct. 29. Vol. 35. No. 44. pp. 2556–2570. With 6 charts in text.

The principal conclusions of this careful survey of a Californian rice ranch and its vicinity are (1) that mosquitoes (both Anopheles and Culex) breed almost entirely in the natural puddles and ditches of the area and hardly at all in the rice fields, though there is no appreciable difference in quantity and quality of food supply, and though natural enemies are most numerous where mosquito larvae are most abundant and fewest where mosquito larvae are practically absent; (2) that the most striking difference between the natural waters and the rice fields is the existence in the latter of a heavy growth of blue-green algae and of surface films composed of minute algae (many diatoms), protozoa, bacteria, etc., all matted together by a yellowish-brown flaky stuff of unknown origin; (3) that *Anopheles occidentalis* is present throughout the year, though most abundant in August and September—no males were, however, found from the middle of November to the end of April.

A. A.

LAMBORN (W. A.). **The Habits of a Dipteron Predaceous on Mosquitos in Nyasaland.**—*Bull. Entom. Res.* 1920. Dec. Vol. 11. Pt. 3. pp. 279–281.

The writer observed the Anthomyid fly *Lispa* preying on larvae, pupae, and emergent adults of mosquitoes. He observed also four other species of Diptera suspiciously engaged on the water, one of them unsuccessfully assaulting mosquito larvae. [The late Dr. J. M. ATKINSON, of Hongkong, sent to the London School of Tropical Medicine many years ago specimens of *Lispa sinensis* and of a Dolichopodid fly observed by him to prey upon mosquito larvae.]

The writer also observed mosquito larvae attacking with mortal effect a Syrphid larva.

A. A.

DALZIEL (J. M.). **Crab-Holes, Trees, and other Mosquito Sources in Lagos.**—*Bull. Entom. Res.* 1920. Dec. Vol. 11. Pt. 3. pp. 247–270.

Among the 14 species found to breed in crab-holes are *Stegomyia fasciata* and *Anopheles costalis*; among the six species in tree-holes, *S. fasciata*; among the twelve species in wells, *S. fasciata*, *A. costalis*, and *Culex fatigans*; among the five species in agbo pots, *S. fasciata*, and *A. costalis*; among the six species in roof-gutters, *S. fasciata*, *A. costalis* and *A. mauritianus*; among the eight species in domestic waters, *S. fasciata*, *C. fatigans*, *A. costalis*, and *A. mauritianus*.

Between May, 1914, and August, 1918, 47 species of Culicidae have come to notice in Lagos Municipal area, including *A. costalis*, *A. funestus*, *A. mauritianus*, *A. obscurus*, *A. nili*, *C. fatigans*, *Mansonia africanus* and *uniformis*, *S. fasciata*, and three species of Uranotaenia.

A. A.

BLACKLOCK (B.) & CARTER (H. F.). **Observations on Mosquitoes in the Isle of Man.**—*Ann. Trop. Med. & Parasit.* 1921. Apr. 27. Vol. 15. No. 1. pp. 73–90. With 5 plates and 1 map.

The survey here recorded was made in part of November and December and was confined to places easily reached by rail and tramway. The species found were *Anopheles bifurcatus* (larvae, abundant and widely distributed), *A. maculipennis* (hibernating females, not so numerous as was expected), *A. plumbeus* (larvae, not associated with *Ochlerotatus geniculatus*), *Culex pipiens* (females), *Theobaldia annulata* (larvae, pupae, and adults), *Culicella morsitans* (larvae of various sizes), and *Culicella fumipennis* (larvae, only in one locality).

A. A.

EDWARDS (F. W.). **Mosquito Notes. ii.**—*Bull. Entom. Res.* 1921. June. Vol. 12. Pt. 1. pp. 69–80.

Among other things in this paper are descriptions of two new species of Anopheles:—

(1) *A. flaviceps*, from the Anglo-Egyptian Sudan; "apparently most nearly related to *A. turkhudi*, Liston, and *A. hispaniola*, Theo. (which may be a local form of *A. turkhudi*), but differing in the paler colour of the integument, especially of the head, almost obsolete frontal tuft, more numerous prosternal hairs, more shining mesonotum, and somewhat less conspicuous wing-markings"; there are also differences of detail in the male hypopygium.

(2) *A. amictus* from Queensland, Australia, differing from *A. annulipes*, Walker, in the following particulars—the proboscis entirely dark-scaled in both sexes; the antennae of the female shorter and stouter, the last ten joints all being of about the same length and thickness; the abdomen rather densely clothed with broad flat scales on all segments except the first, the dorsal scales mostly yellowish but with a patch of dark in the middle of segments 4–6, the ventral scales mostly whitish; the white spots on the legs larger, the posterior surface of the front tibiae being almost entirely white; and the first longitudinal vein with 14–18 black spots, all small. The author states that this proposed new species is very close akin to *A. annulipes* and that "some specimens show intergradation in some respects."

The author also draws attention to a new variety, *hackeri*, of *A. leucosphyrus*, in which, in the female, the proboscis is longer than the palpi by an amount equal to the length of the two terminal palpal segments, and the white rings of the palpi are very narrow. He also discusses *A. punctulatus* and its varieties *moluccensis* and *tessellatus*.

A. A.

BALFOUR (Andrew). **Mosquito Breeding in Saline Waters.**—*Bull. Entom. Res.* 1921. June. Vol. 12. Pt. 1. pp. 29–34.

A useful list of references and commentary on the breeding of mosquitoes in salt and brackish waters. It deals chiefly with species that are known to carry disease, and its purpose is practical.

A. A.

GRIFFITTS (T. H. D.). **Anopheles and Sea Water, with Observations on the Influence of Salinity on the Development of American Species.**—*Public Health Rep.* 1921. May 6. Vol. 36. No. 18. pp. 990–1000.

This paper contains numerous references to the subject of the breeding of various species of Anopheles not only in sea water, but also in sea water which has become concentrated to more than half its bulk by evaporation. It also contains a series of detailed observations on the tolerance of sea water of three American species of Anopheles. One of these, *A. crucians*, was found to propagate in sea water diluted to a maximum salinity of 10,088, or slightly more than 50 per cent. average sea water: larvae which had begun their development in brackish water continued it when transferred to sea water. *A. quadrimaculatus* was not found breeding in large numbers in water of salinity over 10,003; larvae transferred from fresh water to sea water of salinity 10,160 were all killed within 12 hours. *A. punctipennis* was not found in salt or brackish waters: larva put into sea water all died within seven hours.

A. A.

LAMBORN (W. A.). **The Nature and Function of the Caudal Tufts of Malayan Anopheline Larvae.**—*Bull. Entom. Res.* 1921. June. Vol. 12. Pt. 1. pp. 91–97. With 3 text figs.

The author figures and describes the anchoring hook-like endings of the hairs of the dorsal tail-tufts of certain Anopheles larvae, particularly of those that live in running streams, and draws attention to their function. He also describes and figures a pair of hooks terminating the paddles of the corresponding pupae.

It is strange that these interesting adaptations should have been overlooked hitherto.

A. A.

WESENBERG-LUND (C.). **Contributions to the Biology of the Danish Culicidae.**—*Mém. Acad. R. Sciences et Lettres Danemark.* (Sect. des Sci.) 1920–1921. 8th Ser. Vol. 7. No. 1. pp. 1–210. With 21 plates and 19 text-figs.

This is a particularly full and scrutinous account, occupying over 200 pages and illustrated by 21 plates, of the Culicidae of Denmark.

One chapter, devoted to Anopheles and malaria in that country, is of great general interest.

A. plumbeus seems to be a rare species. *A. bifurcatus* is found mainly in forests, but often flys into bedrooms after eight o'clock at night, and inflicts a painful bite: in dull muggy weather it may be seen on the wing in the middle of the day, its powers of flight being good. When the author began his investigations he thought *A. maculipennis* was a rare species, and he was therefore much astonished when he found it to be incredibly common. In the open it *is* rare, since it spends its adult life, except when engaged in the actual processes of reproduction, in outhouses, stables, cow-sheds, etc., feeding entirely upon pigs, cattle, and horses, and not upon man. The author discusses the bearing of these facts upon the malaria problem.

Why has malaria, which up to three generations ago was common in Denmark, now disappeared, though in every farmstead *Anopheles maculipennis* is still abundant? The author considers this question at great length and comes to the conclusion that, whatever may be the influence of contributory factors, the main causation is the change in the character of Danish farming. In the old days of arable crops and open pastures it would frequently happen that man was a more easily procurable prey than cattle for *Anopheles maculipennis*. But in the modern system of co-operative dairy-farming the domestic animals are concentrated in good permanent shelters where the insect can and does concentrate on them. Man, therefore, who is only a *pis aller* for *A. maculipennis*, escapes attack; and thus the malaria chain has been broken by a change of circumstances, highly agreeable to the insect's tastes, which have brought about a change in the insect's habits.

The author thus, independently, endorses the views of E. Roubaud (see this *Bulletin*, Vol. 16, p. 103) regarding the protective value of domestic animals, against malaria, in Western Europe.

A. A.

Swellengrebel (N. H.) & Swellengrebel de Graaf (J. M. H.). [In Dutch and English.] **Onderzoekingen over de verspreiding der Anophelinen in verband met die der malaria in eenige stations van Java en Sumatra.—Researches on the Anophelines at some Stations of Java and Sumatra in Connection with the Occurrence of Malaria.**—*Meded. Burgerlijk. Geneesk. Dienst. in Nederl.-Indië.* 1919. Deel. 10 pp. 1–67. With 4 folding maps and 1 chart in text

An interesting abstract of an official report on a systematic survey of several rural districts, townships, and groups of villages, in which the intensity of the local malaria (as estimated by spleen examination) is in each case considered in relation to local topography and specific distribution of Anopheles and their breeding-places. Of all the species of Anopheles discovered or reasonably inferred to be dangerous *A. ludlowi* is the one most frequently mentioned. In some places this species disappears in October-November; in certain places the distance between the haunt of the adult and possible breeding-places was not less than 1·3 to 1·6 kilometres. In their miscellaneous observations on the bionomy of Anopheles the authors note the tendency of rain, particularly of rain at night, to drive certain species (e.g., *sinensis*, *fuliginosus*, and also *maculatus*) into houses.

A. A.

i. DE MELLO (Froilano) & BRÁS DE SÁ (L. J.). [In Portuguese and French]. Contribuição para o estudo da fauna anofelina da India Portuguesa.—Contribution á l'étude de la faune anophéline de l' Inde Potugaise [*sic*].—*Arquivos Indo-Portugueses de Med. e Historia Nat.* Nova Goa. 1921. Vol. 1. pp. 1–40. With 4 plates.

ii. LÉGER (Louis). Moustiques de Camargne. Un Anophéline nouveau pour la faune française, le *Myzorhynchus sinensis*, Wied.—*C. R. Soc. Biol.* 1920. Dec. 18. Vol. 83. No. 37. pp. 1609–1610.

iii. PENNA (Belisario). Ligeiras observaçôes sobre os habitos dos dois mosquitos predominantes no Rio de Janeiro.—o "*Stegomya fasciata*" e o "*Culex fatigans*."—*Brazil Medico.* 1921. Feb. 5. Year 35. Vol. 1. No. 6. pp. 76–81.

iv. SALOM (C. E.). Sobre algunos dipteros y otros insectos de la Guayana Venezolana.—*Gac. Med. de Ciudad-Bolivar.* 1921. Mar. Vol. 7. No. 80. pp. 121–126.

i. A very good descriptive account, with tabulated synopsis and illustrations of specific characters, of the Anophelines of Portuguese-India: contains nothing new or original.

ii. The author notes the occurrence, in abundance, of *Anopheles* (*Myzorhynchus*) *sinensis*, in the marshes of Camargue, situated east of the Rhône.

iii. A long account of these two common circumtropical species, but not containing anything novel.

iv. A hazy sketch introducing by their vernacular names some of the orders of insects and arachnids of local repute.

A. A.

SWELLENGREBEL (N. H.). [In Dutch and English.] *Myxidium myzomyiae*, **een parasitische Haplosporidie uit het darmkanaal van eenige Anophelinen.** *Myxidium myzomyiae*, **a Parasitic Haplosporidium found in the Intestinal Tract of some Anophelinae.**—*Meded. Burgerlijk. Geneesk. Dienst. in Nederl.-Indië.* 1919. Pt. 10. pp. 68–72. With 5 figs.

Description and figures of a Haplosporidian parasite found in the inner wall of 3·3 per cent. of females of *Anopheles indefinitus* examined at Modjowarno. [A parasite of similar appearance has lately been observed by Colonel C. GILL and the reviewer in some specimens of *Anopheles maculipennis* examined for evidence of malarial infection.]

A. A.

FLU (P. C.). [In Dutch and English.] **Onderzoek naar den levensduur van** *Stegomyia fasciata* **bij lage temperaturen.—Tests re the Period in which** *Stegomyia fasciata* **can live at Low Temperatures.**—*Meded. Geneesk. Lab. Weltevreden.* 1920. 3rd Series A. Nos. 10, 11 and 12. pp. 494–501.

The author being questioned as to the possibility of infected Stegomyia being disseminated with bananas, etc., in the refrigerators of ships, undertook a series of experiments to test the resistance of these insects to cold. The experiments are described, and the conclusions are that in refrigerators at a temperature of 6° C. or lower, *S. fasciata* perishes without doubt after 24 hours; that at temperatures varying between 7° and 10° C. the insects are benumbed immediately, but are not actually dead until at least four days afterwards; and that in a ship's

refrigerator if the temperature be constantly above 6° C., and the voyage take less than 6 days, "there is a small chance" ("hoewel kleiner kans bestaat") of the insects being brought from place to place alive.

A. A.

HILL (G. F.). **Notes on some Unusual Breeding-Places of** *Stegomyia fasciata*, **Fabr., in Australia.**—*Ann. Trop. Med. & Parasit.* 1921. Apr. 27. Vol. 15. No. 1. pp. 91–92. With 1 plate.

Numerous larvae and pupae of *S. fasciata* and *Ochlerotatus notoscriptus* were found in a tin lying in dense scrub 600 yards distant from any dwelling; and again larvae of three species, including *S. fasciata*, were found in a rot-hole in a Poinciana tree.

A. A.

LARROUSSE (Fernand). **Étude systématique et médicale des phlébotomes.**—106 pp. With 20 text figs. 1921. Paris: Vigot Frères, Editeurs, rue de l'École-de-Médecine 23. [Price not stated.]

This very complete study of the genus *Phlebotomus* consists of three parts, the first dealing with natural affinities, anatomy, biology and bionomy, and with methods of observation, preservation, etc.; the second being taxonomic and specifically descriptive; and the third being occupied with a discussion of the pathogenic implications of these insects; in conclusion, there is an exhaustive bibliography filling ten pages of small print.

To give an abstract of this extremely valuable piece of work is not necessary, since its conspicuous merit consists not in any novelty of fact, but in comprehensiveness of statement and lucidity of treatment; it is, in short, a small encyclopaedia, which every one must become possessed of who requires to study the genus *Phlebotomus*, whether from the entomological or the medical standpoint.

In the systematic part the species are consorted geographically, and for each great geographical region they are synoptically tabulated and individually described. The synoptic tables include only the male sex; but, as the author says, the original descriptions of the different species of Phlebotomus do not follow a uniform plan, so that it is difficult to compare them when they refer only to the female, in which sex the specific differences are not so imposing as they are in the male.

A. A.

FRANÇA (Carlos) & PARROT (L.). **Introduction à l'étude systématique des Diptères du genre** *Phlebotomus*.—*Bull. Soc. Path. Exot.* 1920. Oct. 13. Vol. 13. No. 8. pp. 695–708. With 4 text figs.

The authors in the course of a dissertation on the genus propose to distribute the species of Phlebotomus in two subgenera characterised as follows:—(i) Subgenus *Phlebotomus*: Distal segment of upper claspers of male nearly as long as the proximal segment; middle claspers with a digitiform and fimbriated appendage; lower claspers short and armed. (ii) Subgenus *Sergentomyia*, França; Distal segment of upper claspers of male decidedly shorter than the proximal segment: middle claspers without fimbriated and digitiform appendage: lower claspers long and unarmed.

They furthermore hint at a third subgenus, *Neophlebotomus*, for *P. malabaricus*, Annandale, conforming to Sergentomyia, except in having spines on the lower claspers.

A bibliography, not professing to be complete, is appended.

A. A.

FRANÇA (Carlos). **Observations sur le genre Phlebotomus. ii. Phlébotomes du Nouveau Monde. Phlébotomes du Brésil et du Paraguay).**—*Bull. Soc. Portugaise des Sci. Nat.* 1920. Vol. 8. No. 3. pp. 215–236. With 4 text figs.

The South American species of Phlebotomus, particularly those appertaining to Brazil and Paraguay, are here dealt with, the European and North African species having been considered in *Broteria*, ser. zool. 1919. Vol. 17. Certain species are redescribed, a new species (*P. migonei*) from Paraguay is described, and the males of the seven known species are differentiated in a synoptical table.

Reviewing the genus as a whole the author now proposes to segregate the species in three subgenera as follows :—

Phlebotomus : spines on the upper and lower claspers ; distal segment of the upper claspers elongate ; middle claspers with fimbriated digitiform appendage. Type, *P. papatasii*.

Sergentomyia : spines on upper claspers only, distal segment of these claspers generally small ; middle claspers simple. Type, *P. minutus*.

Lutzia : spines on upper and middle claspers. Type, *P. longipalpis*.

The author proposes to bring out a monograph of the Phlebotomines of the whole world, and for this purpose he makes a general appeal for specimens—particularly from Central and Southern Africa, Madagascar, America, Asia, and Oceania—and notes of habits, etc., addressing his appeal from Collares in Portugal.

A. A.

NEWSTEAD (R.). **On the Genus** *Phlebotomus*. **Part iv.**—*Bull. Entom. Res.* 1920. Dec. Vol. 11. Part 3. pp. 305–311. With 4 text figs.

The male of *P. antennatus*, Newstead, is described. *P. sergenti*, Parrot, is described : the male can be distinguished from every other species possessing paired brushes between the superior claspers, by the great length of the subproximal spine of those claspers ; but except for its smaller size the female is not to be distinguished from *P. papatasii*. *P. signatipennis* is described as a new species having as a characteristic feature an extremely small submarginal cell.

A. A.

NEWSTEAD (R.) & SINTON (J. A.). **On a Collection of Pappataci Flies (*Phlebotomus*) from India.**—*Ann. Trop. Med. & Parasit.* 1921. Apr. 27. Vol. 15. No. 1. pp. 103–106.

The species of Phlebotomus here recorded were collected (with the exception of one specimen) at Dera Ismail Khan, Tank, Bannu, the Tochi Valley, and other places on the North-West Frontier of India. They include *P. papatasii*, *P. minutus*, *P. minutus* var. *antennatus*, and *P. sergenti*.

A. A.

FRANÇA (C.). **Sur la détermination spécifique d'une femelle de Phlébotome.**—*Bull. Soc. Path. Exot.* 1921. Jan. 12. Vol. 14. No. 1. pp. 23–24.

The author gives a table rather too esoteric for reproduction for the discrimination of the females of the European species of *Phlebotomus,* from which he determines the species taken by MANSION in the Rhône District, and assigned by him to *P. papatasii,* to be really *P. perniciosus.*

A. A.

LARROUSSE (F.). **Nouvelle espèce américaine du genre** *Phlebotomus. Phlebotomus Brumpti,* **sp. nov.**—*Bull. Soc. Path. Exot.* 1920. Oct. 13. Vol. 13. No. 8. pp. 659–662. With 3 text figs.

This new species of Phlebotomus comes from Brazil and resembles *P. vexator,* Coquillet, from North America in having five spines on the upper claspers of the male.

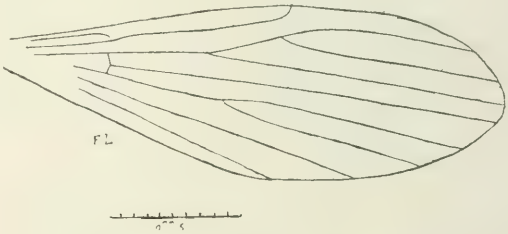


Fig. 1. Wing of *P. Brumpti,* ♂.

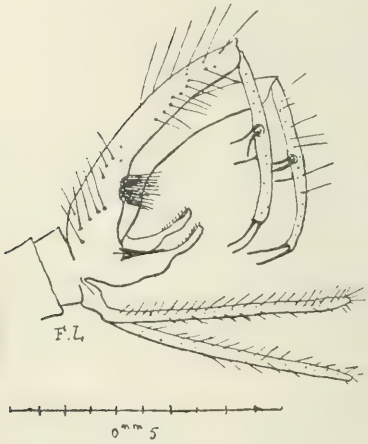


Fig. 2. Genital armature of *P. Brumpti,* ♂

[Reproduced by permission from *Bulletin de la Société de Pathologie Exotique.*]

The wing of the male is three times as long as broad; the first longitudinal vein ends almost at the level of the branching of the first submarginal cell: the first submarginal cell is three times as

long as its stem. The proximal segment of the upper claspers of the male has a conspicuous tuft of hairs in the proximal half of the ventral border; the distal segment is long and uniformly slender, and has two spines at the tip, two on a common tubercle about the middle of the inner surface, and one a little beyond the middle of the ventral border. The lower claspers are very long, uniformly slender, and unarmed. Abdominal hairs recumbent.

The author gives a catalogue of nine American species of *Phlebotomus*.

A. A.

PARROT (L.). **Sur une Variété nouvelle de** *Phlebotomus minutus*, **Rond.** *Bull. Soc. Hist. Nat. Afrique du Nord.* Algiers. 1921. Feb. 15. Vol. 12. No. 2. pp. 37–40. With 1 fig. [Summarized in *Rev. Applied Entom.* 1921. Vol. 9. Ser. B. p. 95.]

Phlebotomus minutus var. *fallax* is here characterized.

A. A.

PARROT (L.). **Sur l'armure génitale des phlébotomes du groupe** *minutus*, **Rondani, et sur** *Phlebotomus fallax*, **nov. sp.**—*Arch. Instituts Pasteur de l'Afrique du Nord.* 1921. Mar. Vol. 1. No. 1. pp. 99–102. With 1 text fig.

Phlebotomus fallax is proposed as a new species approximate to *P. minutus* and its variety *africanus*, but distinguished from the last by the slenderer make of the male claspers and by the absence of the bristle-like spine at the middle of the lower border of the distal segment of the upper claspers.

The author formerly considered *P. fallax*, which has been found in several places in Algeria and Tunis, to be a variety of *P. minutus*.

A. A.

KIEFFER (J. J.). **Sur quelques diptères piqueurs de la tribu des** *Ceratopogoninae*.—*Arch. Instituts Pasteur de l'Afrique du Nord.* 1921. Mar. Vol. 1. No. 1. pp. 107–115. With 6 text figs.

The Ceratopogoninae of the Leptoconops alliance are here by Kieffer generically distinguished, by female characters.

The author also describes three new species of the Leptoconops group, namely *Microconops vexans*, *Tersesthes camelorum*, and *Holoconops transversalis*; and two new species of Culicoides, namely *C. cordatus* and *C. sergentii*, the last being proposed as type of a new subgenus *Diplosella*: all are from N. Africa, except *C. cordatus*, which is from the neighbourhood of Libau.

Two new genera of the Atrichchopogon group are incidentally proposed and briefly characterised, namely *Lasiohelea* and *Gymnohelea*.

A. A.

CARTER (Henry F.), INGRAM (A.) & MACFIE (J. W. S.). **Observations on the Ceratopogonine Midges of the Gold Coast with Descriptions of New Species. Parts 1, 2 and 3.**—*Ann. Trop. Med. & Parasit.* 1920. Nov. 27. 1921. Feb. 8. Vol. 14. Nos. 2 & 3. pp. 187–208. With 3 plates; pp. 211–274. With 27 text figs, and 2 plates; pp. 309–331. With 13 text figs.

A full and good description of the external anatomy of Culicoides, that of the adult being particularly complete. It is preceded by a

general introduction in which the bionomy is carefully considered; is followed by excellent descriptions of the adult, and also in most cases of the larva and pupa, of all the local species of the genus, no less than eleven of which are new; and is concluded with a tabulated synoptical summary of the species. Would that all systematic zoology were set forth in this masterly style

Part 3 gives descriptions and figures of six new species, namely *Prionognathus marmoratus*, *maculipennis*, *pseudomaculipennis*, and *maculithorax*, *Atrichopogon xanthaspidium*, and *Stilobezzia spirogyrae*.

Prionognathus is characterised as a new genus allied to *Culicoides* but still more closely related to *Alluaudomyia* of Kieff, from which it differs only in the absence of microscopic pubescence from the wings, though long hairs are present on the distal portion of the wings.

A. A.

CARTER (Henry F.). **A Revision of the Genus** *Leptoconops*, **Skuse.**—*Bull. Entom. Res.* ·1921. June. Vol. 12. Part. 1 pp. 1-28. With 10 text figs.

This is a very full and comprehensive account of the Ceratopogonine genus *Leptoconops*, the author having examined the majority of the known species of the genus, including the genotype, *L. stygius*. The author concludes that Tersesthes of Townsend, Centrotypus of Grassi, Mycterotypus of Noe, Mycteromyia of Lutz, and Holoconops and Schizoconops of Kieffer, are all synonyms of Leptoconops (*sens. lat.*). The species of Leptoconops are widely distributed round the globe, but so far as is known are confined between 40°N. and 35°S., approximately. Nothing is known of the life-history or early stages, and comparatively little of the habits of the adults beyond the fact that some of the species are notorious for their bite and at certain seasons are serious pests to man and domestic animals. GRASSI endeavoured to infect *L. irritans* with malaria parasites, but was unsuccessful.

In the description of the genus a very careful account of the superficial structural features is given. In the systematic classification the species are arranged in three subgenera, namely, Leptoconops (s.s.), in which which the antennae of the female consist of 14 segments; Holoconops, in which the antennae of the female consist of 13 segments; and Acanthoconops (a new subgenus), which is distinguished from Leptoconops (s.s.) in having the front clothed with bristles or spines.

All the species and varieties, to the number of 18, are carefully described and their distinguishing characters are also summarized in tabular form.

A. A.

WOLLMAN (E.). **Le rôle des mouches dans le transport de germes pathogènes étudié par le technique des élevages aseptiques.**—*C. R. Acad. Sci.* 1921. Jan. 31. Vol. 172. No. 5. pp. 298-301.

This paper gives the results of infection experiments with flies reared by the aseptic method (described in *Ann. Inst. Pasteur.* Vol. 25, p. 79) which starts with sterilizing the egg.

Sterilized eggs of the common blowfly, the green blowfly, and the house-fly were placed under sterile conditions on a sterilized pabulum. When the maggots appeared, suspensions of *Bacillus typhosus*, or

B. dysentericus, or *B. tuberculosis* were introduced, or in some cases, *B. anthracis*.

The *contents* of pupae reared under such conditions gave positive cultures of the respective microbe. But the *flies* issuing from such pupae sometimes gave positive cultures, and sometimes did not; and if the puparia were sterilized by washing and were kept in sterile tubes, the issuing flies—whatever the infection—were always clean. The author, therefore, concludes that pathogenic germs ingested in the maggot stage do not pass on to the fly unless by germs adhering to the surface of the pupa.

House-flies infected with pure cultures of *B. typhosus*, *B. dysentericus*, and *B. tuberculosis* were enclosed in sterile vessels containing absorbent cotton wool moistened with sugar and water: kept unchanged in these circumstances they were persistently infective, in one case for more than three weeks; but if the vessel in which they were kept was changed every day, or every second day, they became clean very much sooner, in some cases in about 8 days, and in one case (where the infection was *B. tuberculosis*) in 4 days.

A. A.

HILL (G. F.). *Musca domestica*, **Linn., as a "Bush Fly" in Australia.** —*Ann. Trop. Med. & Parasit.* 1921. Apr. 27. Vol. 15. No. 1. pp. 93–94.

The author has frequently captured *Musca domestica* on stock and carcases at distances up to two miles from dwellings in the Darwin district. On one occasion he found them on fresh carcases of buffaloes in scrub three to six miles from the nearest dwelling, which itself was 16 miles distant from any other dwellings and 30 miles distant from a town. On two occasions he has taken full-grown maggots of *M. domestica* in decaying vegetable matter forming the stranded but occupied nests of grebes.

A. A.

AWATI (P. R.). **Bionomics of Houseflies. IV. Some Notes on the Life-History of Musca.**—*Indian Jl. Med. Res.* 1920. July. Vol. 8. No. 1. pp. 80–88.

The species under observation are *Musca divaricata* (? *nebulo*) and *M. promisca* (? *angustifrons*). The mean temperature was 82° F. The flies were provided with fresh goat-dung taken from the bowel of a slaughtered animal, fresh human faeces, and syrup and banana juice; this provision was made daily, the stale material being removed for examination. Horse dung was not used as it was invariably infected with nematode parasites of house-flies. The following are the principal results of the observations:—

Flies became sexually mature from five to eight days after emergence; females did not require to be fertilized more than once in life, and began to lay eggs from four to ten days after pairing; many more than four batches of eggs were laid in an individual lifetime. *M. divaricata* preferred goat dung, *M. promisca* preferred human faeces for its eggs. *M. divaricata* did not lay less than 50 eggs, *M. promisca* never more than 50 in a batch. Unfertilized females laid eggs, which did not hatch. There was no appreciable difference of longevity in the sexes. The complete life-cycle—egg to egg—was 20 to 30 days for *M. divaricata* and 19 to 28 days for *M. promisca*.

A. A.

AWATI (P. R.). **A Note on the Genitalia of Portchinsky's Species** *M. corvina* **(Vivipara) and** *M. corvina* **(Ovipara).**—*Indian Jl. Med. Res.* 1920. July. Vol. 8. No. 1. pp. 89–92. With 1 plate

The author has examined the genitalia of these two forms and pronounces them to be two perfectly distinct species, which should therefore be referred back to their specific names; *M. corvina*, Fabr. and *M. autumnalis*, Dig. He thus confirms the suspicions of BEZZI that PORTCHINSKY had confused two closely related species.

A. A.

PLATH (O. E.). **A Muscid Larva of the San Francisco Bay Region which sucks the Blood of Nestling Birds.**—*Univ. California Public. Zool.* 1919. Feb. 7. Vol. 19. No. 5. pp. 191–200.

In introducing his own observations the author refers to the discovery by DUFOUR in 1844 of larvae of *Lucilia dispar* sucking the blood of young swallows, and to similar cases of parasitism since then recorded of the larvae of *Protocalliphora azurea* and *P. chrysorrhoea*, besides other more notorious species.

In an investigation extending over 11 weeks in 1917 the author examined 63 nests of 5 species of birds, and in 39 cases he discovered bloodsucking Muscid larvae, the number in the individual nest ranging from 8 up to 155, and the species in every case but one being *Protocalliphora azurea*. He satisfied himself by plentiful experiment not only that the larvae ingested blood, and actually attached themselves to nestlings, but also that they would not eat such substances as fruit, bread, meat, and boiled potato, though they would feed on the blood contained in a raw beef-bone (but not on simple shed blood of man or ox). According to the author's observations, from five to ten per cent. of the parasitised nestlings die from loss of blood, and some that withstand their attack are much weakened.

A. A.

MARCHAND (Werner). **The Early Stages of Tabanidae (Horse Flies).** —*Monographs of the Rockefeller Institute for Medical Research.* 1920. Nov. 15. No. 13. 203 pp. With 15 plates. 1920. New York: The Rockefeller Institute for Medical Research.

This is a useful summary of present knowledge of the subject, not entirely critical, but quite enough so to be extremely helpful. Introduced by a historical resumé, which begins with a paper published by DE GEER in the Transactions of the Royal Swedish Academy for 1760 on the larval and pupal stages of the European *Tabanus bovinus*, and ends with some notes on the eggs and larvae of some South American species of Tabanus by BODKINS and CLEARE in the *Bull. Entom. Res.* for 1916, its contents include both general accounts of the Tabanid type of larva and pupa and particular descriptions of eggs and larvae and pupae of numerous species of *Tabanus*, *Chrysops* and *Haematopota*. There are also notes on Hymenopterous parasites of eggs of Tabanus, and a reference to Nematode parasites repeatedly found by the author himself in larvae of a Chrysops—a rather suggestive discovery. Outside the three genera above mentioned hardly anything is known of other Tabanid larvae, except BRAUER'S account of the larva and pupa of *Hexatoma pellucens*, and several accounts

of the early stages of *Goniops chrysocoma*, the larva of which is quite peculiar among Tabanidae so far known in being piriform and not at all pointed at the ends; the mother fly in this species, too, guards her egg-mass sometimes for a week. The paper ends with notes on methods of rearing Tabanid larvae, and a bibliography.

A. A.

HILL (G. F.). **The Bionomics of *Tabanus aprepes*, and other Australian Tabanidae.**—*Bull. Entom. Res.* 1921. June. Vol. 12. Pt. 1. pp. 41–62. With 21 text figs.

The breeding circumstances and the post-embryonic history and development of *Tabanus aprepes*, *T. rufinotatus*, *T. nigritarsis*, and *Silvius notatus* are here described in very careful detail and with particular completeness in the case of the species first named.

The chief breeding-places of *T. aprepes* are shallow swamps that dry up in the winter. The eggs are laid on herbage overhanging the water, the number in a mass averaging about 500, and they hatch in 6–7 days. The larvae, which begin and accomplish their first moult while and within a few hours of hatching, appear to be entirely aquatic until they are full grown, when they leave the water and bury themselves in high ground close by, but do not pupate for several months afterwards. The entire larval period, as observed in the laboratory, ranged from 164 to more than 239 days, a larva of the latter age having been killed for examination. The usual difficulties occurred in rearing larvae under laboratory conditions; when an entire brood (from 300 to 600 eggs) was reared in a single receptacle, only 1–2 per cent. reached the imago stage, although plenty of suitable food, etc., was supplied. The pupal stage ranged from 8 to 20 days. The author remarks that the adults of this species show considerable variation in the colouring of wings and abdomen.

The egg-masses and the larvae of *T. rufinotatus* are not easy to find. The larvae were observed to have undergone their first moult within 21 hours of hatching. Under laboratory conditions the larval period occupied 8½ months. Larvae were once captured in association with those of *T. aprepes* and *nigritarsis*, and once with those of *Silvius notatus*.

The breeding-places, larva, and pupa of the last two species are described from a limited capture of apparently full-grown larvae in each case.

A. A.

NEWSTEAD (R.) & EVANS (Alwen M.). **New Tsetse-Flies (*Glossina*) from the Belgian Congo.**—*Ann. Trop. Med. & Parasit.* 1921. Apr. 27. Vol. 15. No. 1. pp. 95–102. With 6 text figs.

Glossina schwetzi is described from six males and five females captured by Dr. SCHWETZ in the Kwango River region of Belgian Congo near the Angola frontier, as a new species of the *G. fusca* group. The male resembles *G. tabaniformis* and the female resembles *G. brevipalpis*. The diagnosis of the species is as follows:—"Hairs of the third antennal segment about one-sixth to one-seventh the width of the segment; wings of the female with the thickened portion of the anterior transverse vein darker in colour than the rest; harpes of the male divided into three processes, the proximal process short

and spine-like; female with signum of the uterus consisting of a single chitinous plate, the long axis transverse and widest in the distal third."

Glossina fusca var. *congolensis* is also described as a new variety from 14 specimens, including both sexes, captured by Dr. SCHWETZ in the Katompe and Lomami-Kisengwa districts of Belgian Congo.

The diagnosis is as follows:—"Colour and pattern generally as in typical *G. fusca*, Walker, but the wings are usually more heavily infuscated. Harpes of male with the proximal process reaching to the tip of the second (serrated) process; bilateral portions of the signum of the uterus of the female subrotund."

A. A.

JOHANNSEN (O. A.). **The First Instar of** *Wohlfahrtia vigil* **Walker.**—*Jl. Parasit.* 1921. Mar. Vol. 7. No. 3. pp. 154–155.

Wohlfahrtia vigil, like other Sarcophagidae, is larviparous, and the new-born larva, observed by the author, is here described, the species sometimes being parasitic on man. A list of references is appended.

A. A.

PATTON (W. S.). **Cutaneous Myiasis in Man and Animals in India.**—*Indian Med. Gaz.* 1920. Dec. Vol. 55. No. 12. pp. 455–456.

As the result of a continued and extensive investigation the author has discovered the maggot of *Chrysomyia* (*Pycnosoma*) *bezziana* to be the one most baneful to man and animals in India. It is a species heretofore known only in Belgian Congo and West Africa, where also its maggot is hurtful to animals. According to the author, it lays its eggs only in or on *living* tissues, and the maggots die if placed on a dead animal. The author emphasizes the importance of this fact and also the significance of the fact that the adult fly has never been seen in nature.

Among other harmful species of maggots in India, the author has observed *Lucilia argyrocephala* (in animals), *Chrysomia* (*Pycnosoma*) *dux* (in animals), *Apiochaeta xanthina* Speiser (*ferruginea* Brunetti) in man and animals, and a *Sarcophaga* in man.

(Among maggots infesting the *intestine* of man, the author has observed *Philaematomyia crassirostris* and a species of Sarcophaga.)

A. A.

CRAGG (F. W.). **The Distribution of the Indian Species of the Genus** *Xenopsylla* **with reference to the Immunity of Certain Areas from Plague Epidemics.**—*Indian Jl. Med. Res.* (Special Indian Science Congress Number, 1920). pp. 29–34.

The facts propounded in this paper are that whereas *Xenopsylla cheopis* has been assumed to be the one and only species of rat-flea existing in India, a careful examination, by the author, of 4,270 rat fleas collected in 18 Indian stations, has disclosed 2·7 per cent. to be *X. brasiliensis*, 29·8 per cent. to be *X. astia*, and only 64·5 per cent. *X. cheopis*—the remaining 2·89 per cent. being Ceratophyllus.

These being the facts, the author points out that as all the species of a genus cannot be assumed to be alike in their physiological reactions, in their length of life and fecundity and rate of development under

differing meteorological conditions, in their resistance to unfavourable circumstances, and in their idiosyncrasies of habit, so these species of rat-fleas may not be assumed to be alike in their susceptibility to infection by the plague bacillus and in their propensity to attack man, and so may not be alike in their capability of spreading plague from rat to rat and from rat to man.

[The author's argument is worthy of respectful consideration; but it may equally be maintained that all the individuals of a species may not be assumed to be quite alike in physiological susceptibilities and reactions, also that the criteria of species fluctuate; and, therefore, that the argument is rather more academic than the author is disposed to allow.]

As far as the author's observations go, *X. cheopis* appears to predominate in the cooler parts of India, and *X. astia* in the warmer and damper parts, and *X. brasiliensis* has been found hitherto only in Poona, Mangalore, Bombay city, and Ootacamund.

A. A.

JORDAN (Karl) & ROTHSCHILD (N. Charles). **On *Ceratophyllus fasciatus* and some Allied Indian Species of Fleas.**—*Ectoparasites.* London. 1921. Jan. 15. Vol. 1. Pt. 3. pp. 178–198. With 30 text figs.

This paper is the outcome of a question by Mr. Tertius CLARKE regarding some possible significance in the geographical distribution of *Ceratophyllus fasciatus*. The authors have examined a certain amount of Indian material, and although they find in it eight species of Ceratophyllus from rodents, and all of them not distantly related to *C. fasciatus*, the only Indian specimens of true fasciatus are one from a brown rat in Bombay and one from a buffalo at Bareilly.

A. A.

i. ROTHSCHILD (N. Charles). **The Generic Name of the Sand-Flea.**—*Ectoparasites.* London. 1921. Jan. 15. Vol. 1. Pt. 3. pp. 129–130.

ii. JORDAN (Karl) & ROTHSCHILD (N. Charles). **A New Species of Sarcopsyllidae.**—*Ibid.* pp. 131–132. With 2 text figs.

i. The author is much obliged to Mr. J. H. DURRANT for having drawn his attention to a compilation by Felix Paul JOROCKI, written in Polish and published in Warsaw, where in the sixth volume dated 1838, the sand flea is diagnosed and figured as *Tunga penetrans*. As the generic name *Sarcopsylla* of Westwood was given in 1840, and *Dermatophilus* Lucas in 1839, Tunga takes precedence. The chiggers, therefore, must by law of priority be called *Tunga*.

ii. The author's figure and describe a new species of Tunga found in the ear of sewer rats from Ning-po in China. This species, *Tunga caecigena*, is quite devoid of eyes, has the fourth segment of the maxillary palp twice as long as the second, and has three bristles on either side of the fifth segment of the tarsus of the first pair of legs.

A. A.

BUXTON (P. A.). **On the *Sarcoptes* of Man.**—*Parasitology.* 1921. June. Vol. 13. No. 2. pp. 146–151. With 9 text figs.

The author has made a careful study of the external anatomy of the itch-mite of the horse as a basis and standard (*Parasitology.*

1921. June. Vol. 13. pp. 114–145), and he deals here with the itch-mites of man, our knowledge of which is, as he says, not very satisfactory.

His human material has been collected from a large number of different cases, both civil and military, and he therefore feels justified in assuming that he is dealing with human itch and not with equine scabies in man. As the result of very careful and detailed comparison, he comes to the conclusion that the common itch-mite of man and that of the horse are varieties of one species, *Sarcoptes scabiei*, de Geer. Certain minute differences exist in the scales and spines of the two varieties, but they are not constant and the measurements overlap. Size, pigmentation of female plastron, and extent of bare areas (rugose areas) have no taxonomic significance.

As regards the mite associated with Norwegian crusted scabies, *Sarcoptes scabiei crustosae of* Fürstenberg, he finds that it can be distinguished from the common itch-mite, *Sarcoptes scabiei* var. *hominis* by one character only, namely the greater size of the spines—a character that can be appreciated only by means of an oil-immersion lens and a micrometer, and may reasonably be regarded as merely varietal. He therefore names it *Sarcoptes scabiei* var. *scabiei-crustosae*.

He furthermore gives at full length a reasoned argument to justify the conjecture that Norwegian crusted itch may be a condition due to a secondary infection with *Aspergillus*.

A. A.

STEKHOVEN, Jr. (J. H. Schuurmans) & NOTOKWORO (Haden Mas). **Zur Biologie der Krätzmilben.** [The Biology of the Itch-Mite.] —vii + 152 pp. With 1 folding plate and 92 text figs. 1921. Apr. Amsterdam: Johannes Müller. [*Verhandl. Konink. Akad. v. Wetenschappen Amsterdam.* (2nd Sectie). Deel 21. No. 2.

This is a full descriptive account of the embryonic and post-embryonic development under various conditions, and of certain points in the anatomy and physiology of the itch-mite of the rat, *Notoedres notoedres*. An appendix contains some remarks on the anatomy and biology of the itch-mite of the cat, *Notoedres cati*, the respiration of *Myobia musculi*, and the egg, larva and powers of endurance of *Myocoptes musculinus*, mites living in the fur of the rat and mouse respectively.

A. A.

DICKSON (W. E. Carnegie). **Mites as Internal Parasites of Man.**—*Jl. Trop. Med. & Hyg.* 1921. Feb. 1. Vol. 24. No. 3. pp. 25–27. With 2 text figs.

Report of two cases where mites and their eggs were found in the urine. One was a young unmarried woman who had suffered for many years from symptoms referred variously to chronic Bright's disease, cystitis, etc. The urine contained much epithelium, some albumin, hyaline casts, and pus, and, in a centrifugated sample, some eggs, a larva, and three adult female mites; more ova and mites were discovered in another centrifugated sample drawn by catheter. Examination of the bladder by cystoscope revealed an aggregation of pinkish elevations on the trigon. After prolonged treatment, the details of which are reserved for future publication, the patient's condition improved and mites could not be found. The mites were identified as *Aleurobius farinae* (the common flour-mite).

In the other case, a man of middle age, the bladder appeared quite healthy, though mites and ova were found in the urine passed, their exuviae and fragments in urine drawn by catheter, and a nymph in urine drawn from the right ureter. The mites were identified as Tarsonemus [but the figure so named is not that of a Tarsonemid]. The patient in this case was suffering from leucocythaemia, with enlargement of the spleen and general enlargement of the lymphatic glands; but the author does not explicitly suggest that these conditions were the result of infestation with mites. The patient at last died. Before death he had symptoms of cystitis and pyelitis, but no mites were then discovered in his urine; nor was post mortem examination permitted.

A. A.

FINDLAY (William F.). **Cheese-Mite Itch and Conjunctivitis. A "Minor Horror" of the Great War.** —*New Zealand Med. Jl.* 1921. Apr. Vol. 20. No. 96. pp. 146–150; and *New Zealand Jl. of Health & Hospitals.* 1921. Mar. Vol. 4. No. 3. pp. 57–60.

Cheese is infested not only by the cheese-mite Tyroglyphus, but also by the flour-mite (Aleurobius), the sugar-mite (Glyciphagus), the fruit and jam-mite (Carpoglyphus) and the bulb-mite (Rhizoglyphus).

The species implicated in the cases of conjunctivitis and itch here recorded was *Tyroglyphus longior.* The cases occurred among people handling cheese in stores in New Zealand, where, owing to difficulties of transport due to the war, the storage of cheese was abnormally protracted. For the dermatitis ordinary soothing ointments were found effective, betanaphthol ointment particularly so. For the conjunctivitis the routine conjunctival treatment was promptly efficacious. If the temperature of the store-house kept constantly at 35° F. the mites did not become troublesome, but were not killed. Good results were obtained with carbon bisulphide, 13 lb. to 5,000 cub. feet; this kept the mites down for six months. The brushing of shelves, etc., with a 5 per cent. solution of carbolic acid is also recommended.

A. A.

RODHAIN (J.). **Remarques au sujet de la Biologie de l'*Ornithodorus moubata*.** —*Ann. Soc. Belge de Méd. Trop.* Brussels. 1920. Nov. Vol. 1. No. 1. pp. 133–138.

The author reinforces his previous statements as to the resistance offered by dense humid forests to the spread of *Ornithodorus moubata*, owing to its preference for more arid savannah tracts. He states that the species now exists west of Boma from the R. Lukunga to the Atlantic littoral. By experimental observations he finds that *O. moubata* can live and thrive in all stages of its existence, and can give issue to healthy fertile eggs, on the blood of cold-blooded Vertebrates, *e.g.* snakes (including the venomous *Causus rhombeatus*) and geckos.

A. A.

SENEVET (G.) & VIALATTE (Ch.). **A Propos d'*Ornithodorus marocanus* Velu, 1919.** —*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14. No. 6. pp. 331–333.

VELU in 1919 described *Ornithodorus marocanus*, a new species attacking man and pig, from Morocco; he placed it near *O. turicata*.

The authors have examined VELU's specimens and compared them with other specimens of their own from the same country, and they have discovered that, besides its affinities with *O. turicata, O. marocanus* also resembles *O. talaje* in possessing lateral flaps to the camerostome.

A. A.

MARTIAL (R.) & SENEVET (G.). **Présence à Fez d'** *Ornithodorus talaje* (**Guérin-Méneville, 1849**). **Action pathogène sur l'homme.** —*Bull. Soc. Path. Exot.* 1921. Jan. 12. Vol. 14. No. 1. pp. 24–26.

Ornithodorus talaje is commonly supposed to be an American tick, NUTTALL and his collaborators doubting the correctness of the determination of those who have reported its existence in the Aral region and in Venice. The present authors now report the species from Fez, and describe the effects of its bite. The patient, a female, received at least 20 bites in the course of a night. The local effects were intense and extensive, itching lasting for four weeks, and petechiae, which did not disappear entirely for 5 months. About 36 hours after being bitten the patient showed signs of collapse—nausea, which persisted for 15 days, and great weakness of the pulse ; from the 4th to the 8th day afterwards the temperature was at 38·7° C. The authors attribute this introduction of *O. talaje* to pigeons.

A. A.

HOUSSAY (B. A.). **Action physiologique du venin des scorpions** (*Buthus quinquestriatus* **et** *Tityus bahiensis*).—*Jl. de Physiol. et de Path. Gén.* 1919. Vol. 18. No. 2. pp. 305–317.

The active principle of these venoms is soluble in water and in glycerine, but not in alcohol, ether, chloroform, etc. The toxin is thermolabile (to 70°), is absorbed by animal charcoal, and does not pass through a Berkefeld filter. The aqueous extract of the venom gland of *Buthus quinquestriatus* has no diastatic action. The venom studied is above all a muscle poison of the veratrin type, and a powerful salivary and lachrymal stimulant ; it increases reflex excitability, has generally a hypertensive action somewhat similar to that of adrenalin, and causes contraction of unstriped muscle. The respective antitoxins are strictly specific.

A. A.

ALLEN (A. H.) **A Case of Poisoning by Jellyfish.** —*U.S. Nav. Med. Bull.* 1920. July. Vol. 14. No. 3. pp. 396–397.

The case occurred in the York river. The jellyfish are merely referred to as "of the white variety." The immediate symptoms were intolerable burning and itching, followed in 15 minutes by violent coryza. Erythema and profuse weeping eczema supervened. After 10 hours of unsuccessful local treatment, the intense irritation was relieved by a hypodermic injection of morphia. Subsequently the patient lost his voice, and haemorrhages were observed in the right vocal cord. The inflammation of the vocal cord persisted for over four weeks, the appearance resembling tubercular laryngitis.

A.A.

PELLAGRA.

WILSON (Wm. H.). **The Diet Factor in Pellagra.**—*Jl. of Hyg.* 1921. July. Vol. 20. No. 1. pp. 1–59. With 3 charts in text.

The paper opens with a discussion of the fundamental question of protein assimilation. The sufficiency of protein must not be reckoned by its gross weight, but by its assimilable value. In other words, the important factor is the biological value of the protein. Proteins differ considerably in their biological value. For estimating the comparative value of a given amount of protein one has to divide the total quantity by one of the following factors :—Animal protein, 1 ; rice protein, 1·12; potato, 1·27; pulse, 1·82; wheat flour, 2·55; maize, 3·4. Thus a man weighing 70 kilos, to maintain his nitrogenous equilibrium, must take 30 grains of protein daily if he take meat as his source, but 102 grams of protein if he consume the maize variety. The figure 40 may be taken as the minimum of safety for the biological value of protein, though many healthy individuals may escape disease with a B.P.V. of only 20. When hard labour is indulged in 50 would be a safer figure, and for a community with chronic intestinal disease, or one previously affected with pellagra, a figure even of 60 is not too high.

With these preliminary considerations the author discusses the diets associated with the various outbreaks of pellagra throughout the world, and shows clearly the connection between deficient protein and the disease.

1. *The Outbreak among Armenian Refugees at Port Said.*—The diet which presumably caused the outbreak had a B.P. value as follows : —For males (fifteen years and upwards), 23 ; for females (fifteen years and upwards), 18·4 ; for children (five to fourteen years), 13·8 ; for children up to four years, 7·3. Later the diet was revised and two new scales were instituted, one for the healthy and the other for those who had suffered from pellagra or were ill-nourished. The B.P.V. of the former diet was 43·7 and of the latter 59·15. On these diets the disease practically disappeared.

2. *The Rankin Farm Experiment.*—The diet administered by GOLDBERGER and WHEELER to convicts, some of whom developed pellagra, showed a B.P.V. of only 1·46.

3. *Diet of Italian Peasants.*—The diet of a hired peasant in the province of Ferrara, where pellagra incidence is about 3 per cent., is as follows :—For eight months of the year B.P.V., 30·4, while for four months of the year it is 43. These figures are higher than those of the Armenian Refugee Camp, and the pellagra incidence is correspondingly lower.

4. *Individual Cases among Egyptian Fellahin.*—Case A. Boy, aged 11 ; B.P.V. of the diet which caused pellagra had a value of 10·4 ; on raising the B.P.V. to 24·9 a cure was affected.

Case B. Boy, aged 12 ; B.P.V. of diet causing pellagra, 1·17. The boy was cured by increasing this figure.

Case C. Boy, aged 15. In this case the B.P.V. of the diet producing intense pellagra was only 10.

5. *Turkish Prisoners of War in Egypt.*—The diet under which a large number of cases of pellagra developed was as follows :—For the non-labour group the B.P.V., after calculating the loss of nitrogen in the faeces, was 33·5. For the labour group, after similar allowance

for faecal nitrogen loss, the B.P.V. was 36·8. The labour group showed a considerably greater pellagra incidence than did the non-labour group.

6. *Convicts in Egypt.*—Among convicts on hard labour receiving a diet of B.P.V. 48·5, the pellagra incidence was 4·4 per cent. Among moderate labour convicts receiving B.P.V. of 33·5 the incidence was 2·8 per cent.; while among light labour convicts receiving the same diet as the preceding class the incidence was only 1·5. On a diet containing protein of biological value of 54·7 most of the cases recovered rapidly.

7. *Intra-mural Cases of Pellagra in Egyptian Asylums.*—These results may be passed over since it is so difficult with insane patients to be sure that the diet provided was actually consumed.

The remaining dietaries discussed in this section are those which are seemingly very poor, and yet pellagra does not develop amongst those subsisting upon them. In all, the B.P.V. was higher than 40.

The second part of the paper deals with other factors which may possibly play a part in the etiology of pellagra. These are :—

" (1) Deficiency in accessory food substances.
" (2) Deficiency of fats and lipoids.
" (3) Deficiency of protein.
" (*a*) Absolute deficiency of intake below the normal requirements.
" (*b*) Deficiency relative to individual or energy requirements.
" (*c*) Deficiency due to low availability of protein resulting from the nature of the food or defective preparation.
" (*d*) Secondary deficiency due to excessive bacterial destruction of protein in the intestine or defective powers of digestion or assimilation."

The significance of indicanuria is discussed.

Three types of pellagra may be distinguished etiologically :—

" (*a*) The common type seen in poverty or deficient food from other causes.
" (*b*) Relapse cases in which, owing to permanent defects—the result of a previous attack of pellagra—the protein supply is inefficiently utilized.
" (*c*) Cases in which a disease of the digestive organs, due to other causes than insufficient feeding, leads to defective utilization of the protein intake."

[This paper undoubtedly is destined to become a classic. That protein deficiency is an important factor in pellagra etiology can no longer be doubted.]

A. D. Bigland.

Wood (Edward J.). **Pellagra.**—*Edinburgh Med. Jl.* 1920. Dec. Vol. 25. No. 6. pp. 363–374. With 1 chart.

This paper constitutes a clinical lecture delivered to graduates at the Royal Infirmary, Edinburgh, on Aug. 9, 1920. A case was shown and described in detail. The chief points are as follows :—

Married woman aged 52 years. Patient had lived in Edinburgh continuously for the last thirty years. Six or seven years ago, during the summer, she noticed a redness of the forearms. Four months ago, weakness of the legs was noticed, and erythema appeared on hands, forearms and neck. Then followed soreness of the mouth and slight salivation. Admitted to the Royal Infirmary two months ago for neurological condition.

Weakness was profound, especially in the lower limbs, no mental symptoms of any kind, all the deep reflexes were absent, and the plantar reflex was flexor. The pupils were normal. The voice suggested the neuritis of diphtheria. Sensation was practically normal though the muscles were somewhat tender on deep pressure. The vibratory sense was fully investigated, the vibration time being considerably reduced except over the sacrum. There was no diarrhoea.

The etiology of pellagra was next discussed and modern views brought forward. The lecturer stated that his personal view was in favour of the food deficiency hypothesis. Under the heading of treatment, he gave his experiences with the giving of maize germ to pellagrins. In one case the result was most encouraging.

A. D. B.

MacNeal (Ward J.). **Pellagra.**—*Amer. Jl. Med. Sci.* 1921. Apr. Vol. 161. No. 4. pp. 469–501. With 13 figs.

This paper is a resumé of our knowledge on the whole subject of pellagra, and therefore should be consulted first-hand by those wishing a bird's eye view of the subject. The author in the etiological section shows that while food deficiency plays a part in the causation of the disease, another factor, probably an infection, must be taken into account.

A. D. B.

Tanner (W. F.) & Echols (G. L.). **The Occurrence of Pellagra in Patients apparently receiving Ample Diet.**—*Jl. Amer. Med. Assoc.* 1921. May 14. Vol. 76. No. 20. pp. 1337–1338.

After describing a case of pellagra occurring in a woman apparently fed upon a suitable diet, many components of which she did not eat, the authors make the following statement :—" It is not proper to assume that because a patient is provided with a certain diet this also is eaten ; there is a danger of drawing erroneous conclusions when the knowledge in hand concerns the available food supply rather than the diet actually consumed by the patient."

A. D. B.

Enright (J. I.). **The Pellagra Outbreak in Egypt.** [Correspondence.] —*Lancet.* 1921. Mar. 19. p. 613.

Dr. Enright in this letter answers his numerous critics [see this *Bulletin*, Vol. 17. p. 148]. It will be remembered that pellagra occurred among German prisoners of war in Egypt, even though the diet was considered as more than sufficient. This fact convinced Dr. Enright that diet deficiency alone was not the cause of pellagra. There must be something else. This is not ascaris infection, as suggested by Dr. H. M. Woodcock, since these helminths were not found invariably post mortem. The whole-hearted believers in the diet deficiency theory of pellagra, headed by Goldberger, suggest that the prisoners did not eat the diet ordered for them. Dr. Enright was in medical charge of these prisoners and he states that they did eat their food. Goldberger's remark that two cases of scurvy occurred among the German prisoners, and, therefore, some diet deficiency must have been present, does not directly bear upon the subject, since symptoms of scurvy and not pellagra were noted

amongst recent political prisoners undergoing "voluntary enforced" abstention from food.

In short, the unanswerable argument is that pellagra occurs when diets are deficient, but it does not by any means always occur; therefore, there is something at work more than mere deficiency.

[The best answer to Dr. Enright's critics will be found in the Report on Investigations on Pellagra among Turkish Prisoners of War in Egypt, 1920, by HAMMOND-SEARLE and STEVENSON. *See below.*]

A. D. B.

HAMMOND-SEARLE (A. C.) & STEVENSON (A. G.). **Report of Investigations on Pellagra among Turkish Prisoners of War, in Egypt, 1920. With a Bacteriological Report by Lt.-Col. P. J. Marett.**—66 pp. With 11 charts. [n.d.] Alexandria: Whitehead Morris Ltd.

The work of the Pellagra Commission terminated with the close of the year 1918. The present investigations commenced in March 1920. By this time the work of repatriation was in full swing and therefore the time was short, and only those observations which were feasible under the time restrictions could be carried out.

During the year 1919 there was a great decline in pellagra incidence, but owing to repatriation of many prisoners, especially pellagrins, it is difficult to estimate the importance of diet, etc., in bringing about this decrease.

Among the Turks up to the end of 1919 there had been 9,257 cases out of 105,668 prisoners (*i.e.*, 1 in 11), while among the Germans there were about 79 cases out of 7,606 European prisoners (*i.e.*, 1 in 96). During 1919 there was a total of 1,617 deaths from pellagra; of these about six were German.

In the dietetic section the following results were obtained. Up to April 1919 the diet for non-working European prisoners of war was probably insufficient to prevent pellagra unless supplemented by extra purchases. For the workers the diet though of good biological protein value was poor in calories. As regards the Turks, the diet was of better calorific value but the biological protein value was too low for safety. The advisability of an authorized standard diet for pellagrins in hospital was emphasized.

In the clinical section of the report the question of the supposed similarity between Addison's disease and pellagra is very fully discussed and, in conclusion, the result is arrived at that "adrenal insufficiency is not a marked feature in pellagra." The abnormal action of the sympathetic nervous system, too, is probably not the cause of the early symptoms of the disease. The post mortem changes in the sympathetic nervous system and in the suprarenals are as readily explained by the the theory of tissue exhaustion as by a selective involvement of these organs in pellagra.

The pathological findings confirm the results of other workers, especially as regards the abnormal condition of the intestinal mucous membrane and the wasting of all the organs, which is greater than that found in any other wasting disease. There is usually a considerable reduction of bile salts in pellagra.

Various dieting and metabolism experiments were carried out, together with estimations of the Nitrogen content of the urine and faeces, indican, etc. An improved method of indican estimation in the

urine is described. [For full details of these experiments the original paper should be consulted.]

Under the last and most important heading, that of etiology, the following points are made. With regard to the diet of the German prisoners of war it is stated that their diet unsupplemented by canteen purchases was "open to the charge of inadequacy;" that the diet was so supplemented by most of the Germans and that "there is evidence that a large proportion of the German pellagra cases were unable to make such extra purchases of food." The authors give it as their opinion that the facts gathered do not preclude the possibility of the food deficiency hypothesis. But following up BIGLAND's work it is clearly pointed out that another factor may be at work which may gain access to the body through damaged intestinal mucosa. In the search for a possible organism behaving in this manner the aid of Lt.-Col. MARETT was invoked. Cultures taken from the faeces of definite pellagra cases and from the small intestine of post mortem cases showed in 90 per cent. of cases organisms undistinguishable from *B. Welchii* and in 85 per cent. of cases terminal or sub-terminal spore-bearing organisms were isolated. Stools from healthy Turks did not show these anerobes. Samples of maize and maize flour obtained from an endemic pellagra centre in Egypt also showed anerobic spore-bearing organisms.

It was attempted to produce ulceration in dog's intestines by dysenteric organisms and then to inoculate these anaerobic organisms and watch the results. Unfortunately the dog's intestine could not be made to ulcerate with the dysenteric organisms. The question, therefore remains undecided.

[The importance of this paper is sufficient apology for the length of the above abstract.]

A. D. B.

GOLDBERGER (Joseph). **A Study of the Relation of Family Income and other Economic Factors to Pellagra Incidence in Seven Cotton-Mill Villages of South Carolina in 1916.** *Public Health Rep.* 1920. Nov. 12. Vol. 35. No. 46. pp. 2673–2714.

The author gives the following summary and conclusions :—

"1. In the present paper are reported the results of the part of the pellagra study of cotton-mill villages, during 1916, dealing with the relation of conditions of an economic nature to the incidence of pellagra. It is the first reported study in which the degree of the long-recognized association between poverty and pellagra incidence is measured in a definite, purely objective manner.

"2. The study was made among the white mill-operatives' households in seven typical cotton-mill villages in South Carolina. Pellagra incidence was determined by a systematic, bi-weekly house-to-house canvas and search for cases, only active cases being considered. Information relating to household food supply, family income, etc., was secured by enumerators for a sample section of the period April 16 to June 15, assumed to be representative of the season during which the factors favouring the production of pellagra were assumed to be most effective.

"3. Family income was made the basis of classification according to economic status, the Atwater scale for food requirements being used for computing the size of families in comparing their incomes.

"4. In general, pellagra incidence was found to vary inversely according to family income. As the income fell, the incidence of the disease rose and showed an increasing tendency to affect members of the same family; as the income rose, the incidence fell, being reduced almost to the point of

practical disappearance in the highest of our income classes, although the income enjoyed by this class was comparatively low.

"5. The inverse correlation between pellagra incidence and family income depended on the unfavourable effect of low income on the character of the diet; but family income was not the sole factor determining the character of the household diet.

"6. Differences in incidence among households of the same income class are attributable to the operation of such factors as tend to determine the amount and proportion of family income available for the purchase of food, the intelligence and ability of the housewife in utilising the available family income, and to the differences among households with respect to availability of food supplies from such sources as home-owned cows, poultry, gardens, etc.

"7. Differences in incidence among villages whose constituent households are economically similar, are attributable to differences among them in availability of food supplies resulting from differences (*a*) in the character of the local markets, (*b*) in the produce from adjacent farm territory, and (*c*) in marketing conditions.

"8. The most potent factors influencing pellagra incidence in the villages studied were (*a*) low family income, and unfavourable conditions regarding the availability of food supplies, suggesting that under the conditions obtaining in some of the villages in the spring of 1916 many families were without sufficient income to enable them to procure an adequate diet, and that improvement in food availability (particularly of milk and fresh meat) is urgently needed in such localities."

A. D. B.

BORY (Louis). **Contribution a l'étude de l'origine de la pellagre.**—*Progrès Méd.* Paris. 1920. Oct. 23. Vol. 35. No. 43. pp. 461–462.

The author has seen two possible cases of pellagra and describes them in more or less detail. A brief résumé of pellagra etiology is given and the opinion propounded that in one of the cases cited infection was the most probable cause.

A. D. B.

FINDLAY (G. Marshall). **A Study of the Leucocyte Changes in Pellagra compared with those occurring in Beri-beri.**—*Jl. Path. & Bact.* 1920. Dec. Vol. 23. No. 4. pp. 490–498.

The author draws the following conclusions:—

"(1) In pellagra there is a slight increase in the total, but a decrease in the percentage neutrophil count.

"(2) In beri-beri there is a decrease in the total, but not in the percentage neutrophil count.

"(3) In pellagra there is an increase both in the total and percentage lymphocyte count.

"(4) In beri-beri there is a decrease in the total, but not in the percentage lymphocyte count."

A. D. B.

DE KOCK (P. J.) & BONNE (C.). **Pellagra in Suriname.**—*Nederl. Tijdschr. v. Geneesk.* 1920. Sept. 11. Vol. 64. Pt. 2. No. 11. pp. 965–972. With 1 double plate.

The author describes two cases of pellagra occurring in Surinam.

Case 1. Mulattin, aged 70. Symptoms present were sore mouth, salivation, cachexia, pigmentation on hands, feet, face and vulva, slight fever and mental changes. She died five months after admission to hospital.

Post mortem examination revealed pulmonary gangrene, perisplenitis and hepatitis, small haemorrhages in the upper part of the ileum and cyst-like growths in the colon.

Case 2. Male of European descent, aged 40. During first hospital admission was diagnosed as facial erysipelas. Re-admitted later with pellagrous eruption on face, hands and forearms. The patient was nervous, debilitated, sleepless and suffered from constant abdominal pain. Intractable diarrhoea set in which continued till his death. There was no post mortem.

The first asylum case of pellagra in the district was diagnosed in 1915. Since then ten cases have been recorded. The authors are of the opinion that many more cases exist but have not been diagnosed. They lean to the food deficiency theory of the disease.

A. D. B.

MACKAY (Malcolm). **Two Cases of Pellagra in Canada.**—*Canadian Med. Assoc. Jl.* 1921. Jan. Vol. 11. No. 1. pp. 41–42. With 2 text figs.

The author states that in Canadian literature he can only discover two cases of pellagra; both occurred in 1916. He gives an account of two more cases.

Case 1. Married woman, aged 21. Lived in England till August, 1919, when she came to Canada; Sept., 1919, delivered of a normal child. She had always been a small eater, but had never partaken of maize in any form. Occasional attacks of diarrhoea without skin lesions. Present illness began in February 1920 with weakness, headache, indigestion, diarrhoea; later, marked stomatitis. Stools contained pus and mucus. The rash was typical. The knee jerks were absent on both sides as were also the abdominal reflexes except in the left upper segments. The blood pressure was low and there was a running temperature for a time. The finger and toe nails were discoloured and loose. Patient gradually improved on Goldberger's diet and arsenic. Discharged well on October 22, 1920.

Case 2. Married woman. Aged 42. Always lived in Canada. Appetite was never good, but corn was only rarely eaten. For several years suffered from headache, indigestion and depression. For some months the mouth had been sore. Early in the summer of 1920 symmetrical erythema appeared on the arms, followed later by diarrhoea with blood and mucus in the stools. In September dizziness set in and a little later weakness, especially down the left side. The rash and stomatitis were typical. The case was complicated by carcinoma uteri, and though kept upon Goldberger's diet, she died on October 10, 1920, in a comatose condition.

A. D. B.

STRASSBERG (Maximilian). **Versuche zur Behandlung der Pellagra mit Eigenserum.** [Experiments on the Treatment of Pellagra with Auto-Serum].—*Wien. Klin. Woch.* 1921. Apr. 7. Vol. 34. No. 14. pp. 162–163.

Previous workers have shown that toxic maize extracts can be neutralized by the addition of the serum of patients recovered from pellagra. Such a protected maize extract is harmless when injected into rabbits, whereas animals treated with toxic maize extracts alone usually died. Ordinary human serum did not give this protective power. It has also been shown that rabbits treated with the toxic maize extract previously neutralized with the serum of convalescent pellagrins showed an increased resistance to that extract. Other

observers have not been able to confirm these results. COLE obtained good results with blood transfusion in pellagrins but could not satisfy himself that better results were obtained when convalescent pellagrins were the donors.

In the author's experiments 20–40 cc. of blood were taken from a series of pellagra patients. The resulting serum (10–17 cc.) was injected into the pellagra patient, usually intra-gluteally but sometimes subcutaneously. This was repeated every three or four days. On the average, patients received three to six such injections, but one received eight. Only typical pellagra cases were used. Out of sixteen patients treated on these lines eight lost the rash and other complaints after three to six injections, four cases recovered after three to eight injections ; two cases were refractory and in two the treatment could not be continued. The author stated that normally it takes months for pellagra symptoms to disappear and that therefore his results are satisfactory. Owing to his departure from the scene of the experiments the author was unable to discover whether the symptoms returned.

A. D. B.

SULLIVAN (M. X.), STANTON (R. E.) & DAWSON (P. R.). **Metabolism in Pellagra ; A Study of the Urine.**—*Arch. Intern. Med.* 1921. Apr. Vol. 27. No. 4. pp. 387–405.

" The study of the urine in pellagra at the U.S. Pellagra Hospital in 1917 may be summarized as follows :

" (1) The mineral metabolism seemed to be abnormal, especially in the actively pellagrous stage, as witnessed by the low P_2O_5 excretion despite the fact that the diet taken at the time was a generous one with abundance of milk.

" (2) Indications were present of a heightened putrefactive process in the intestines.

" (3) The presence of casts or albumin, or both casts and albumin, in the urine, gave evidence of more or less kidney change in about 50 per cent. of the cases. Marked pellagra can occur with no evidence of kidney change.

" (4) There was low excretion of total nitrogen and the ordinary urinary ingredients.

" (5) The urea ratio, in general, was low, and in certain cases with fair total nitrogen, the urea ratio was lower than should be expected : a finding which suggests liver insufficiency.

" (6) There was a heightened ratio for ammonia nitrogen and undetermined nitrogen.

" (7) The metabolic level during the active stage of the disease was low, as further shown by the low excretion of uric acid and creatinin.

" (8) The creatinin coefficient was much below normal.

" (9) The utilization of protein was found to be subnormal, even after several weeks of a remedial diet.

" (10) With at least a month on the curative diet, the urinary ingredients rose to approximately normal amounts, the urea ratio rose to normal and the ammonia ratio fell to normal.

' (11) As suggested by Goldberger, Wheeler and Sydenstricker, the disease may be differentiated into at least two types : (i) A type with marked skin symptoms, but with little physical degeneration ; and (ii) a type with slight skin symptoms, but with profound systemic involvement. The abnormality in the urinary findings was greater for the systemic type than for the dermal type."

A. D. B.

SULLIVAN (M. X.). **Alkali Tolerance in Pellagra.**—*J. Amer. Med. Assoc.* 1921. Apr. 9. Vol. 76. No. 15. pp. 1002–1003.

The author draws the following conclusions :—

" The data on venous carbon dioxid tension and alkali tolerance of the pellagra patients at the Pellagra Hospital in 1920 support the findings obtained with more marked cases of pellagra in 1918 and 1919 by the venous carbon dioxid tension method and by the carbon dioxid bound by the blood plasma, that, as a rule, the alkali serve [reserve] in pellagra, though tending somewhat downwards, is within normal limits. Of fifteen patients tested, only four showed an increase in tolerance to sodium bicarbonate. Of these four patients, only two showed a marked tolerance, and these two patients had a severe diarrhoea."

A. D. B.

UNDULANT FEVER.

BASSETT-SMITH (P. W.). **Para-Melitensis Infection in Man and Animals.** —*Jl. Trop. Med. & Hyg.* 1921. Mar. 1. Vol. 24. No. 5. pp. 53–54. With 2 charts in text.

Working with a strain of *M. para-melitensis* obtained from NICOLLE, Bassett-Smith found that it showed much more definite bacillary forms than freshly isolated *M. melitensis*, that it was more easily agglutinated by non-specific sera and also more auto-agglutinable. Immunization of rabbits with this strain was more difficult than with *M. melitensis* and the agglutination curve obtained was usually low. Group agglutinins for *M. melitensis* in the para-melitensis serum were more marked than were similar agglutinins for *M. para-melitensis* in the melitensis serum.

The following technique is recommended for the agglutination test: "Take sufficient serum and divide this into two parts, heat one in the water bath at 37°C. for half an hour. Use a 48-hour growth of a reliable culture to make the emulsion, with or without formalin; put up three dilutions of each serum, 1 : 40, 1 : 100, 1 : 400, and place in the incubator at 37°C. for two hours, and then stand in the cold and read off in twenty-four hours." Controls with normal and specific sera should be put up at the same time.

Details of four of the author's cases of para-melitensis infection in man are given, the disease having been contracted in southern Europe in every instance. One case was practically convalescent when first seen—another proved fatal as the result of a secondary streptococcal infection. Another made a good recovery while under treatment with the appropriate vaccine. The fourth died after receiving five injections of para-melitensis vaccine (initial dose 250 millions), to which the reactions were very severe and accompanied by an intense purpura; old endocardial lesions were present and complicated the findings but a local necrosis at the site of injection was caused, and the author suggests that with para-melitensis infection there is an increased danger of secondary infections both in man and in animals.

W. Byam.

BASSETT-SMITH (Percy W.). **Undulant Fever.**—*Jl. Trop. Med. & Hyg.* 1921. July 1. Vol. 24. No. 13. pp. 173–176. With 2 charts in text.

The author notes as an important factor in the epidemiology the extension of the disease to districts far from the sea, such as Central Africa and Texas. He classes the cases as ambulant without symptoms, mild fevers lasting about 14 days (often unrecognized), long-continued remittent fever lasting about four months, and an intermittent type which led to the use of the term Mediterranean phthisis: this, which often follows the remittent type, appears to be common in South Africa. He refers in some detail to the effects on the nervous system. The author now generally uses a sensitized vaccine, but withholds it when the temperature is very high. During the war he feared a fresh development of the fever, but in the Navy there were in the five years only 63 cases. He details the laboratory methods of diagnosis he employs, giving his technique:—

"The most certain is the isolation of the micrococcus from the blood; I prefer to do this in the afternoon during a pyrexial wave; 10 cc. of

blood should be drawn off, divided into broth tubes and subcultured every day; a successful culture appears as minute dew-like colonies in 72 hours; or the following method may be used: Take 1 cc. of blood, allow to clot, remove serum with bactericidal substance and substitute broth, on two or three consecutive days; by this means successful cultures have been made when others failed."

A. G. B.

LUGER (Alfred). **Zur Differentialdiagnose des Maltafiebers.** [Differential Diagnosis of Undulant Fever.]—*Deut. Med. Woch.* 1921. Mar. 24. Vol. 47. No. 12. pp. 321–322.

The author's observations were made at Smyrna in 1918. He found that the differential diagnosis had to be made not only from paratyphoid and coli infections, but also from typhoid, sepsis, tubercle, malaria, liver abscess, rheumatism and other forms of specific arthritis.

He notes that in one case of his own, liver abscess had been diagnosed, but the local symptoms and blood examinations should generally separate the diseases. He particularly refers to the lymphocytosis and leucopenia in undulant fever. For malaria he refers to the colour of the skin: in undulant fever this is pale and anaemic, whereas in malaria it has a brownish yellow tint. Greater difficulties are found with paratyphoid infections as the pulse and blood pictures are similar; in coli infections the lagging of the pulse behind the temperature is not found as in typhoid and undulant fever.

With regard to agglutination tests these were very uncertain; he emphasises the importance of using young cultures which have been well attested, careful controls, and the macroscopic method. He used three strains from the Krall laboratory; one with normal and immune serum gave three times the titre of the other two. Among normal sera and that of other diseases he found positive agglutination in more than half of the cases, as a rule in 1/20 to 1/100, and in some febrile conditions as high as 1/800. The method thus carried out seemed impossible to apply, but by using heated sera (57°C for half an hour) as recommended by NÈGRE and RAYNAUD, the method has again become valuable. The non-specific agglutinins are markedly unstable to long storage and heat of 56°C, reducing those of normal sera almost to nothing, but it also cut down the titre of the specific sera. A high agglutinating serum after heating still retained a titre of 1/200 and remained evident, but if originally low it may be still further reduced. The author considers that in spite of this reduction in titre by heating, the method is indispensable and the most reliable. In chronic cases agglutinins may entirely disappear, and he quotes a case [the same is the experience of the reviewer], but in the majority of instances the method is sound.

For prognosis, the height of the titre gives doubtful results; a low one in acute cases is most important, but in slight cases it has no meaning. High agglutinins are not a safeguard for a favourable prognosis. He remarks that those working with these organisms should for safety use formalin emulsions. He requires an agglutination titre of from 1/200 to 1/400 for diagnosis. [There are many debatable points in this paper, but generally the views coincide with those of other well known workers. It is advisable always to put the test up with both heated and unheated serum, using positive and negative controls, and in titres of 1/40, 1/100 and 1/400.]

P. W. Bassett-Smith.

MEYER (Jean). **Mélitococcie par contamination de laboratoire.**—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1921. May 19. 3rd Ser. Vol. 45. No. 16. pp. 701–705. With 1 chart.

The patient is stated to have broken a tube containing a culture of *M. melitensis* in his pocket, and in spite of all precautions became infected. The important points are, the long incubation period, more than forty days, and the mildness of the disease, which presented six undulations of pyrexia and lasted two months. It is interesting to note that the onset was coincident with the presence of influenza in the family and that when laboratory tests were carried out on the fifteenth day they were negative for undulant fever, but positive on the last day of the sickness up to a titre of 1/400 with unheated, and 1/200 with heated serum. The strain itself had been in the laboratory since 1911 and had possibly become attenuated in virulence. Four other cases of laboratory infections with long incubation periods are mentioned, and the great danger of working with these cultures is emphasized.

[From the chart it appears that neither the commencement nor end of the disease are shown; probably the real onset was earlier than given and the incubation period much less than 40 days. Long latent periods are well known to exist before the patient is notified as being ill.]

P. W. B-S.

i. DARGEIN & PLAZY. **Sur un cas de "fièvre méditerranéenne."**—*Bull. et Mém. Soc. Méd. des Hôpit. de Paris.* 1921. June 2. 3rd Ser. Vol. 45. No. 18. pp. 781–784. With 3 charts in text.

ii. ——. **Sur une forme "atypique" de fièvre méditerranéenne.**—*Ibid.* pp. 784–786. With 3 charts in text.

i. The patient, aged 36, disembarked in March 1920 at Toulon, where he probably contracted the disease. He went to Rocheford suffering from fever and sweats and returned to Toulon at the end of April for treatment in hospital as a case of typhoid. Blood tests gave a positive agglutination with *Micrococcus melitensis* to a titre of 1/1000. The symptoms were distinct, with an irregular type of fever curve running into the intermittent chronic form. The duration was four and a half months and convalescence was incomplete [arthritis was still present]. The blood counts were interesting: at the commencement of treatment the red cells were 3,116,000, they fell to 1,800,000 and rose again at the end to 4,250,000, the white cells at the same time being 7,200, 5,200, and 4,500 with always a low relative polynuclear count. He was treated with vaccines without apparent benefit. No definite source of origin of the infection could be traced.

ii. A man of 29 working at the arsenal at Toulon was sent to the hospital for "gastric fever;" there his case was finally diagnosed as one of undulant fever, but the persistence of diarrhoea for a long period with gastric symptoms was peculiar. Blood cultures and serum tests for the typhoid group gave negative results, but the fever curve and severe sweats suggested a melitensis infection, and a laboratory test confirmed this. Vaccine treatment (10–60 millions) gave rise to considerable reactions, but did not appear to be very useful. The duration of the disease was three and a half months. The infection was attributed to eating goats' milk cheese, which is much used at Toulon and is often *soaked in fresh goats' milk by the vendor to make it look*

better before sale. It was noted that all the other members of the family had escaped the infection. It is probable that undulant fever is much more common at Toulon than is reported, as the irregularity of the fever renders the diagnosis very difficult or impossible without laboratory methods.

P. W. B-S.

ROZIES (H.). **Les formes graves de la fièvre de Malte.**—*Presse Méd.* 1920. Dec. 25. No. 52. pp. 563–565.

The author points out that though the mortality from undulant fever is low (2 per cent.) in naval and military forces, among the civil population affected it is very much higher, 13 or more per cent., and that it is far from being a benign fever. This is chiefly due to severe complications. He instances a case of two months duration accompanied by epistaxis and intestinal haemorrhages, with intense asthenia. Cases with purpura are particularly dangerous.

The severe forms he divides into hyperpyrexial, ataxo-adynamic, haemorrhagic and persistent (*formes interminables*). The associated diseases which increase the morbidity are, malaria, tubercle, typhoid and paratyphoid. The indications for treatment of severe cases are—control the infection by colloidal therapy and vaccine therapy, treat the complications, and maintain the general nutrition.

[A fatal case of para-melitensis infection with extensive purpura reported by BASSETT-SMITH is an instance confirmatory of the danger of these haemorrhagic conditions.]

P. W. B-S.

DAUMAS (A.). **De l'examen du réticulum fibrineux dans la fièvre de Malte.**—*C. R. Soc. Biol.* 1921. Vol. 84. No. 4. pp. 215–216.

The early appearance of an increase of fibrin threads in the blood of two cases of undulant fever is brought forward as a possible early diagnostic sign in differentiation of these cases from those of an enteric nature. The author also noted the high relative lymphocyte counts and rather late appearance of specific agglutinins for the *melitensis* organism, negative on third and ninth day, positive 1–40 on twelfth and 1–2,000 on thirtieth, in one case; negative on fifth, positive 1–20 on tenth, 1–300 on twentieth, and 1–1,500 on fortieth, in the second.

P. W. B-S.

PRINGAULT (E.). **Valeur de la séro-réaction de Wright.**—*C. R. Soc. Biol.* 1921. Jan. 8. Vol. 84. No. 1. pp. 53–55.

The sera of 163 cases other than undulant fever were tested with three strains of *M. melitensis*, following the technique recommended by NICOLLE. With fresh unheated sera, positive results were obtained in dilutions varying from 1–30 to 1–150. With heated sera no agglutinins were found in dilutions greater than 1–100. The author concludes that the reaction has real value provided that:—

(1). A well attested culture is used;

(2). The emulsion is made from at least three strains of *M. melitensis*;

(3). The serum to be tested is heated to 56°C. for half an hour.

(4). A positive result should only be returned when agglutination takes place in dilutions of 1–250 or over.

[This would miss many *chronic* cases, as in these the agglutinins are often very low].

P. W. B-S.

ZIEMANN (H.). **Ueber die Behandlung des Maltafiebers und des infecktiösen Abortes der Rinder mit Kollargol und ähnlichen Präparaten.** [The Treatment of Undulant Fever and Abortus Infections of Cows by Collargol and Like Preparations].—*Deut. Med. Woch.* 1921. May 5. Vol. 47. No. 18. p. 500.

At a meeting of the Microbiological Society in Berlin in May 1920, ZELLER stated that he was unable by laboratory methods to determine any definite distinction between the causative agents of undulant fever of man and abortus infection of cattle, but it does not follow, however, that the two diseases are identical. The author at the meeting described two cases of undulant fever which had received, without benefit, many kinds of treatment and were cured by one or two intravenous injections of 2 to 4 cc. of a two per cent. solution of collargol. As he had no further cases of undulant fever he recommended that veterinary surgeons should give the agent a trial in the allied disease of cattle. It was probable that other metallic colloidal preparations might be found as effective. He quotes other cases where silver colloids had been used with benefit in undulant fever and, unlike SOULEYRE, thinks that these therapeutic agents have direct bactericidal action on the infecting organism.

P. W. B-S.

SOULEYRE (C.). **Recherche d'une méthode de colloïdothérapie dans la fièvre méditerranéenne.**—*Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1921. Feb. 25. 3rd Ser. Vol. 45. No. 6. pp. 176–184. With 5 charts in text.

In 1906 the author had considerable success in treating two cases of undulant fever with colloidal silver, 1–10 cc. of a one per cent. solution. He has followed this up in twelve other cases with good results and he now gives details of one case in which doses of 10 cc. of colloidal gold brought about a sudden fall in the temperature and a marked general improvement. In spite of this the patient had a slight relapse some weeks later, when two injections of 30 cc. of a specific serum from the Pasteur Institute of Algiers were given, which was followed by a permanent cure. He states that these colloidal preparations should not be used in very toxic or complicated cases, but in long moderately severe, sub-acute and chronic ones, without intense cachexia, the treatment is to be recommended. From a study of the cases he deduces the following points : " weak " metallic colloids, even in large doses injected intravenously, give unsatisfactory results. Strong metallic colloid (gold) in large doses will bring about a cure in uncomplicated cases. It is best to work up the dose gradually from 1 cc. to 10 cc. doubling the amount each day, and to guard against the depressant effects of the drug by an injection of oil of camphor or adrenalin, a short time before each intensive dose of the colloidal preparation is given.

[It must be remembered that the disease is apt to have sudden remissions of symptoms suggesting a " post hoc " action of any drug or vaccine given at the time, and great care is required to assess any special line of treatment at its correct value. The method is however one that should be thoroughly tried, bearing in mind the warnings as to unsuitable cases. No definite information is given as to which are " weak " and which are " strong " metallic colloids].

P. W. B-S.

NICOLLE (Charles) & COSTE (E.). **Vaccination préventive de l homme contre la fièvre méditerranéenne.**—*C.R. Acad. Sci.* 1920. Oct. 26. Vol. 171. No. 17. pp. 775–777. With 1 chart.

By a human experiment the authors show that it is possible by subcutaneous inoculations of dead cultures of the *M. melitensis* to protect against contracting undulant fever. The data for the conclusions are however, small. Two persons received two doses of the protective inoculation; one did not. All three were inoculated subcutaneously with 0·5 cc. containing 450 millions of the living organisms which had been used for the immunization. The two previously inoculated did not develop any symptoms; the blood examined on 20th and 32nd day gave no growth by culture, nor showed any evidence of agglutinins, whereas the third case after 17 days incubation developed fever of a characteristic undulant type, showed agglutinins and a positive blood culture was obtained. The absence of agglutinins in the blood of the vaccinated after inoculation with the virulent culture, and their presence in the unprotected case, proves to the authors that the serum-agglutination reaction is a sign of infection and not of immunization.

The laboratory workers using the micrococcus could by this means be easily protected against accidental infections which are, as is well known, only too frequent.

P. W. P.

REVIEWS.

PENNA (José) & BARBIERI (Antonio). **El paludismo y su profilaxis en la Argentina**. Ministerio del Interior, Departamento Nacional de Higiene.—vii+390 pp. With 4 charts, 5 maps, 2 coloured plates and 53 illustrations in text. 1916. Buenos Aires : Establecimiento Gráfico. M. Rodriguez Giles, 434, Loria 444. [Price not stated.]

To more than half a million inhabitants of the fertile Argentine Republic malaria is an urgent problem both of economics and of health. This book is at once a record of the measures undertaken by the State Department of Health and an element in its campaign to rid the Argentine of malaria. The writers are convinced from their experience that material progress has been made, but as no statistics were recorded before 1910 it has not been possible to demonstrate graphically all that has been done. The following table of primary infections among the cases treated is, however, not without significance :—

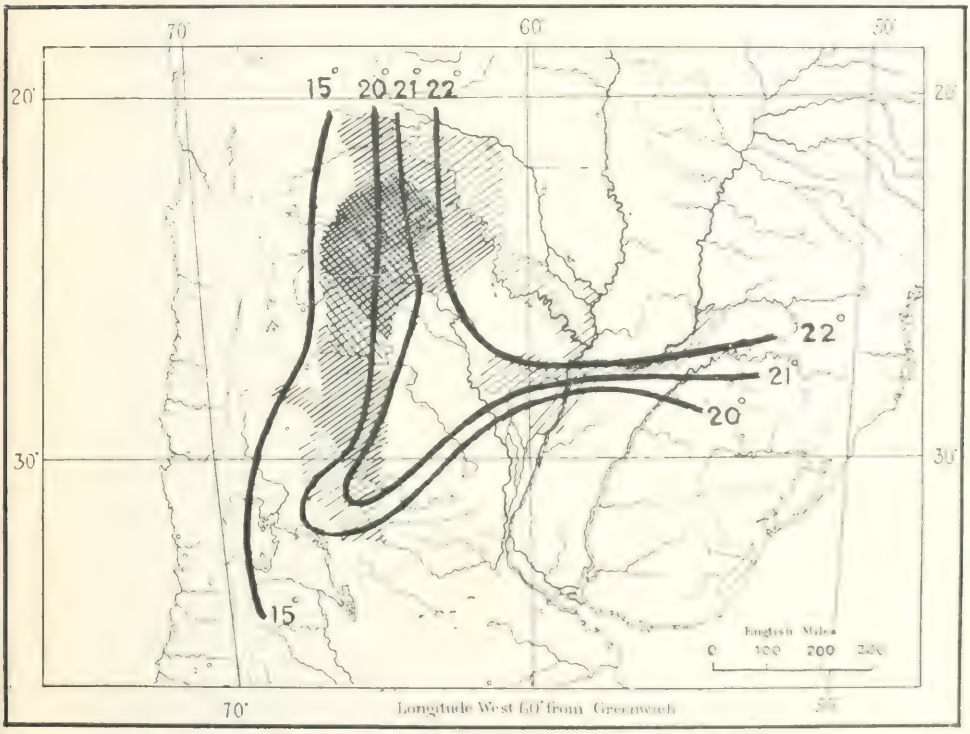
1910	primary infections	24·7	per cent of all cases treated.				
1912	,,	,,	26·1	,,	,,	,,	,,
1913	,,	,,	21·0	,,	,,	,,	,,
1914	,,	,,	14·4	,,	,,	,,	,,
1915	,,	,,	11·9	,,	,,	,,	,,

So much the authors point out in their preface. But reference to further statistical tables (pp. 70-71) shows that the total number of cases treated rose from 75,324 in 1912 to 162,825 in 1915. Obviously under these circumstances too much importance must not be attached to the relative incidence of primary infections and relapsing cases.

Malaria has been known in South America since histories of those peoples were first written. It was certainly endemic in the empire of the Incas at the time of the Spanish conquest, and the specification of chinchona bark was widely known amongst the conquered peoples. "The heat and humidity which made fertile the fields were fatal to the inhabitants," said Washington Irving in his life of Christopher Columbus (1851) and added, "the exhalations of the swamps and of the huge surrounding forests and the action of the sun on that vapourous soil produce European intermittent fevers in the uncultivated tropical regions." The Spanish historians describe epidemics in which the greater part of the population was wiped out. As for the origin of malaria in South America, the authors, after discussing untenable theories, conjecture that the disease travelled across the Pacific with those prehistoric explorers [Professor G. Elliott SMITH tells us that they followed the track of pearls and gold] who have left such unmistakable relics of a schooling in the earliest civilization of the East. There is no gainsaying the probability of this hypothesis. There follows a discussion of the present distribution of malaria in the Argentine, and the authors point to a relation between the intensity of infection and the isothermal lines. This coincidence is illustrated in the accompanying map. The argument is that certain temperatures are more favourable than others for the breeding and wide distribution of anopheles.

Chapter 5 is devoted to the irregular and pernicious forms of malaria amongst which is included *fiebre biliosa hemoglobinurica* or "blackwater-fever." The authors, while mentioning the theory favoured by CASTELLANI that this is a distinct disease of unknown aetiology, evidently themselves incline to the view that it is of malarial origin. It is, they say, only found in malarial districts and in the tropics where the aestivo-autumnal fever abounds. A good description is given of the clinical course of the disease. The differential diagnosis with paroxysmal haemoglobinuria of syphilitic origin is discussed, the conclusion being that the two conditions, for all their similarity, are aetiologically distinct and occur fortuitously in the same tropical areas. A good account is given in Chapter 6 of malaria in children. The writers find that infants at birth and during the period of lactation possess an immunity not to the parasite but against its toxin, for they have found haematozoa of the benign type in the blood of such infants in whom no symptoms or only a very slight pyrexia were to be observed. After the

first year infection becomes progressively more common, a fact which is explicable by the increasing exposure of the children to mosquito bites. The blood of children with slight fever should be regularly examined, for in early years malaria is liable to simulate tuberculosis, gastro-enteritis, influenza, epidemic meningitis, typhoid fever, pneumonia, leucaemia and other diseases. The typical symptoms of malaria, too, are liable to be wanting, for in the first two years sweating rarely occurs and when it does occur is limited to the head and forearms. Intestinal symptoms, tympanitis, pain, diarrhoea, etc., were found to be common. Among 1,022 children examined in the province of Salta, 291, or 28 per cent., were found with enlarged spleens.



ARGENTINE REPUBLIC. Isothermal Lines corresponding with Malarial Regions (After PENNA AND BARLIERI)

Among the Anopheles found in the Argentine are mentioned *A. albitarsis*, *A. annulipalpis*, a relatively rare species, found on the border of the Rio de la Plata and south of Buenos Aires, but not in the northern provinces, and *A. pseudopunctipennis*, which is the mosquito responsible for most of the malaria in the northern provinces. Another malaria carrier is *Anopheles albimanus*, which is only distinguishable from *A. albitarsis* by a black ring round the first and last tarsus of the hind feet.

Thirty-five pages are devoted to the subject of quinine. The Department of Health made use of quinine prophylaxis both in treating chronic cases and distributing quinine amongst the healthy population. Both for convenience of distribution and for the conservation of the drug they preferred to use tablets. The tablets principally used were quinine hydrochloride 0·50 gm. and 0·25 gm., and for distribution among children "chocolatines" of quinine tannate. Formerly the distributors of quinine had been known as *amargos* (the bitter men), but with the introduction of these tablets, manufactured by Burroughs Wellcome, Park Davis, and Boehringer and Soehne of Germany, quinine became popular. The bottles

of tablets were accompanied by admirably designed instructions which are reproduced. The following table shows the amount of quinine distributed :

Year.	Patients.	Grammes of quinine hydrochloride.
1909	30,235	240,150
1910	31,892	372,897
1912	55,324	446,491
1913	128,587	817,985
1914	175,875	1,032,924
1915	165,478	870,308

Quinine haemoglobinuria they describe as rare and only occurring in subjects with "congenital familial predisposition." They recommend subcutaneous injections of neutral hydrochloride of quinine in cases which need rapid treatment or in which there is gastric intolerance. Intravenous injections are considered the method of choice in all very acute or very chronic cases and especially in hospital cases. Salvarsan is used in cases which resist quinine treatment.

The distribution of quinine was only one of many methods of prophylaxis adopted in this very thorough campaign. In addition to fumigation, irrigation, oiling, etc., special attention was paid to popular instruction. The illustration from page 337 is a good example of poster work.

J. Rosslyn Earp.

Lustig (A.) & Franchetti (A.). **Studi ed osservazioni sulla Pellagra. (Commissione Ministeriale per lo Studio della Pellagra).** —Reprinted from *Lo Sperimentale,* 1921. July–December. Vol. 75. Nos. 4–6). 96 pp. [1921. Firenze: Stab. Tipografico Enrico Ariani.]

This volume constitutes the report of a commission nominated by the Italian minister for home affairs in November 1910. The work of the Commission, interrupted by the war, was resumed after the armistice and is now completed. The war itself furnished them with what they consider their most important observation, namely, that during the period of hostilities when many infectious diseases, especially tuberculosis and malaria, showed a marked rise in morbidity, pellagra on the other hand diminished. They consider this important evidence in support of the theory that pellagra is a deficiency disease. This theory obtains further credit from the fact that during the war the diet of the rural populations was both richer and more varied than it had been formerly. The idea that an infection may be carried in certain foods is further discredited in that war conditions resulted in an unusual amount of transport of food-stuffs.

All the important theories of the aetiology of pellagra seem to have been investigated by the Commission, principally with negative results. Thus a sub-commission composed of Drs. Antonini and Alessandrini working in haematology was unable to confirm the mononucleosis described by Sambon. The Commission was also unable to establish any aetiological relation between the occurrence of pellagra and Simulium. Not only Sambon's theory but also those of Alessandrini and Tizzoni were investigated and definitely rejected by a majority of the Commission. As for the maize theories, it is agreed that cases of pellagra in subjects who do not eat maize are the exception rather than the rule, and the special research of the Sub-commission (Drs. Strambio sen., Marzari, Filippo Lussana) agrees with other modern work in attributing pellagra rather to a qualitative food deficiency than to an intoxication. The theory that an essential element is removed from maize in the milling is admitted to be attractive, but the writers point out that no specific anti-pellagra vitamin has been isolated from the rejected portion. But all the recent evidence supports the contention that pellagra is a nutritional disorder for which the excessive proportion of maize in the diet is largely responsible.

J. Rosslyn Earp.

REPRINTS AND PAMPHLETS RECEIVED.

ANALES DEL INSTITUTO GENERAL Y TÉCNICO DE VALENCIA. No. 11, pp. 5–17. Catálogo y descripció d'els Pardels de l'Albufera de Valencia.

ARÉVALO (Celso). Introducción al estudio de los Cladóceros del plankton de la Albufera de Valencia.—*Anales del Instituto General y Técnico de Valencia*, pp. 1–65. With 26 text figs.

BOECK (William C.). *Chilomastix mesnili* and a Method for its Culture.—Reprinted from *Jl. Experim. Med.* 1921. Feb. 1. Vol. 33. No. 2. pp. 147–175. With 5 text figs.

BRUG (S. L.). Die Jodzysten.—Reprinted from *Arch. f. Schiffs- u. Trop.-Hyg.* 1921. Vol. 25. pp. 47–58. With 4 text figs.

——. Un cas grave de clonorchiase traité par l'émétique. Guérison.—Reprinted from *Bull. Soc. Path. Exot.* 1921. Mar. 9. Vol. 14. No. 3. pp. 161–162.

CABALLERO (Arturo). Las especies del género Chara y las larvas de los mosquitos.—Reprinted from *Anales del Instituto General y Técnico de Valencia*. No. 10. pp. 5–17.

CAWSTON (F. G.). Experimental Infestation of Fresh-Water Snails.—Reprinted from the *Trans. Roy. Soc. S. Africa.* 1921. Vol. 9. Pt. 4. pp. 301–303.

——. The Urine of the Bilharzia Patient.—*S. African Nursing Record.* 1921. June. Vol. 8. No. 9. pp. 204–205.

——. Introduction of *Schistosoma mansoni* Infection to South Africa.—Reprinted from *Med. Jl. S. Africa.* 1921. June. Vol. 16. No. 11. pp. 209–210.

——. Schistosomiasis in Natal.—*S. African Med. Rec.* 1921. Aug. 13. Vol. 19. No. 15. pp. 287–288.

——. Treatment of Leprosy.—*S. African Med. Rec.* 1921. Aug. 13. Vol. 19. No. 15. p. 300.

GONZALEZ MARTINEZ (I.). Esprú, anquilostomiasis y bilharziosis. Tres Conferencias dadas en la Facultad de Medicina de Barcelona. Precedidas de un prólogo por el Dr. A. Martinez Vargas.—81 pp. 1920. Barcelona. [Price not stated.]

GUITERAS, LEBREDO & HOFFMAN (W. H.). Diagnóstico de la viruela.—*San. y Benefic. Bol. Ofic.* 1921. July. Vol. 26. No. 1. pp. 11–13.

HORNYOLD (A. Gandolfi). Sobre las angulas del Perelló (Albufera de Valencia).—Reprinted from *Anales del Instituto General y Técnico de Valencia.* pp. 5–32. With 11 text figs.

——. Algunas observaciones sobre la Anguila en Valencia.—Reprinted from *Anales del Instituto General y Técnico de Valencia.* No. 3. pp. 1–42.

——. Algunas observaciones sobre la alimentación de la Anguila en Valencia Santander, Lisboa y Aveiro.—Reprinted from *Anales del Instituto General y Técnico de Valencia.* No. 6. pp. 1–6.

IYENGAR (M. O. Tirunarayana). Preliminary Report of a Malaria Survey of Calcutta and Environs.—Reprinted from *Indian Jl. Med. Res.* (Special Indian Science Congress Number, 1920.) pp. 8–17.

JEPPS (Margaret W.). Notes on Treatment with Emetine at the University War Hospital, Southampton.—Reprinted from *Jl. Roy. Army Med. Corps.* 1921. June. Vol. 36. No. 6. 8 pp.

Reprints and Pamphlets Received—*cont.*

KOFOID (Charles Atwood) & SWEZY (Olive). On the Free, Encysted, and Budding Stages of *Councilmania lafleuri*, a Parasitic Amoeba of the Human Intestine.—*Univ. California Public. Zool.* 1921. June 23. Vol. 20. No. 7. pp. 169–198. With 5 plates & 3 text figs.

KUNHARDT (J. C. G.) & CHITRE (G. D.). An Experiment in the Eradication of Plague Infection carried out in the Poona and Adjacent Districts. First Report. (For the period 1914–1916.)—Reprinted from the *Indian Jl. Med. Res.* 1921. Jan. Vol. 8. No. 3. pp. 409–445. With 13 charts & 5 maps.

—— & ——. Further Experiments in Plague Prevention carried out at Poona. Second Report. (For the period 1916–1918.)—Reprinted from the *Indian Jl. Med. Res.* 1921. Jan. Vol. 8. No. 3. pp. 446–489.

LUSTIG (A.) & FRANCHETTI (A.). Studi ed osservazioni sulla Pellagra.—Reprinted from *Lo Sperimentale.* 1921. July–Dec. Vol. 75. Nos. 4–6. 96 pp.

MILTON (Frank). Suggestions for Further Research in Schistosomiasis.—*Jl. Trop. Med. & Hyg.* 1921. Jan. 15. Vol. 24. No. 2. pp. 13–17 & Feb. 1. Vol. 24. No. 3. pp. 27-31.

OGATA (Tomosaburo & Akira). Henle's Reaction of the Chromaffin Cells in the Adrenals, and the Microscopic Test for Adrenalin.—Reprinted from *Jl. Experim. Med.* 1917. June 1. Vol. 35. No. 6. pp. 807–817. With 1 plate.

PARDO (Luis). Contribución a la parasitologia de la anguila en Valencia.—Reprinted from *Butlleti de la Institució Catalana d'Història Natural.* 1920. June. 2 pp.

ROBERTSON (D. G.). Inquiry into the Prevalence of Tuberculosis at Bendigo.—*Commonwealth of Australia Quarantine Serv. Public.* 1920. Mar.-Aug. No. 19. 70 pp. With 12 text figs.

ROCKEFELLER FOUNDATION. A Review for 1920. The Program for 1921. VINCENT (George E.), President of the Foundation.—47 pp. With 5 maps, 16 text figs. & 1 plate. 1921. New York.

RUSS (Viktor). Studien ueber die Malaria in Niederösterreich.—*Veröffentlichungen des Volksgesundheitsamtes im Bundesministerium für soziale Verwaltung XIV.* 1921. 39 pp.

SIERRA (J. M. Romero). Estudio y clasificacion de un ascaris. Contribucion al estudio de la parasitologia en Venezuela. 13 pp. With 1 plate. 1921. Caracas.

THOMSON (John Gordon) & ROBERTSON (Andrew). The Value of Laboratory Reports on Stools in Cases of Suspected Amoebic Dysentery, and their Interpretation by the Clinician; with a Special Note on the Diagnostic Significance of Charcot-Leyden Crystals.—Reprinted from the *Proc. Roy. Soc. Med.* (Sect. of Trop. Dis. & Parasit.) 1921. Vol. 14. pp. 33–44. With 4 figs.

VIETS (K.) Algunos Hidrácnidos de Valencia.—Reprinted from *Anales del Instituto General y Técnico de Valencia.* No. 9. pp. 1–17. With 13 text figs.

Note.—On direct application (not through agents or booksellers) any of the foregoing reprints or pamphlets will be sent on loan to any part of the world, the Bureau paying outward postage.

BOOKS AND REPORTS RECEIVED.

DANIÉLOPOLU (D.). Le typhus exanthématique—Résultats des investigations cliniques et des recherches de laboratoire entreprises pendant l'épidémie de Moldavie de 1917–1918 sur 600 cas de typhus exanthématique. 512 pp. With 91 text figs. 1919. Bucarest: Inst. d'Arts Graphiques Charles Gobl S-sseur J. St. Rasidesco, 16, rue Paris, 16. [Price not stated.]

VON PROWAZEK (S.). Handbuch der Pathogenen Protozoen. 1920. Lief. 7. pp. 881–1040. With 19 text-figs. & 2 coloured plates. 1921. Lief. 8. pp. 1041–1294. With 100 text figs. & 1 coloured plate. Leipzig: Verlag von Johann Ambrosius Barth.

CYPRUS. Annual Medical Report for the Year ending 31st December, 1921. 26 pp. [THOMPSON, (F. B.), Chief Medical Officer.] 1921. Printed at the Government Printing Office, Nicosia. [Price not stated.]

MAURITIUS. Report on Communicable Diseases in Port Louis. By BALFOUR (Andrew), C.B., C.M.G., M.D., Director-in-Chief of the Wellcome Bureau of Scientific Research, London. 20 pp. Printed by authority of His Excellency, the Governor: P. G. Bumstead, Acting Government Printer, Mauritius. [Price not stated.]

MINISTRY OF HEALTH. Report on the State of the Public Health. Annual Report of the Chief Medical Officer of the Ministry of Health for the Year 1920. 180 pp. 1921. Printed and published by H.M. Stationery Office. [Cmd. 1397.] [Price 1*s*. 6*d*. net.]

PANAMA CANAL. Report of the Health Department of the Panama Canal for the Calendar Year 1920. [FISHER, (H. C.), Colonel, Medical Corps, United States Army, Chief Health Officer.] 129 pp. 1921. The Panama Canal Press, Mount Hope, C.Z.

PHILIPPINE ISLANDS. Report of the Philippine Health Service for the Fiscal Year from January 1 to December 31, 1919. Vicente de JESÚS, M.D., Director of Health. 522 pp. With 2 plates and 3 folding charts. 1920. Manila: Bureau of Printing. [Price not stated.]

PHILIPPINE ISLANDS. Quarterly Report of the Philippine Health Service. First Quarter, 1920. To the Secretary of Public Instruction, Vicente de JESÚS, M.D., Acting Director of Health.] 41 pp. 1920. Manila: Bureau of Printing. [Price not stated.]

DRUGS AND PREPARATIONS RECEIVED.

Messrs. Burroughs, Wellcome & Co. have sent to the Bureau a specimen of "MOOGROL" for the treatment of Leprosy. "MOOGROL" is stated to be a mixture of esters of acids of the Chaulmoogric series. It is a limpid, almost colourless oil, and is issued in bottles of 100 cc. Price in London, 30*s*. per bottle.

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INDIAN MEDICAL GAZETTE. 1918, Vol. 53; 1919, Vol. 54; 1920, Vol. 55.

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION. 1921. Vol. 76. No. 2.

(These are unobtainable from the publishers.)

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